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THE MONIST

A QUARTERLY MAGAZINE

DEVOTED TO THE PHILOSOPHY OF SCIENCE

VOLUME XIX.

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12.7.10

CHICAGO
THE OPEN COURT PUBLISHING COMPANY
LONDON AGENTS
KEGAN PAUL, TRENCH, TRÜBNER & CO., LTD.
1909

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VOL. XIX. JANUARY, 1909. NO. 1

THE MONIST

WILLIAM JAMES, THE PRAGMATIST—A PSYCHOLOGICAL ANALYSIS.

THE DISCOVERER OF METAPHYSICS AS REFLEX ACTION,

I MUST preface my article by saying that I do not intend to pour another bucketful of criticisms into the ocean that is now surging about the rock of pragmatism; I feel no call to improve the philosophy of any one. But I shall be glad if I succeed in understanding Mr. James or any other philosopher for that matter. For me the only way to understand a metaphysical system or theory lies in translating it as far as possible into terms of genetic psychology. As Mr. James has not yet published his autobiography, the task is not very easy, and the interpretations offered are, it is true, largely tentative, but I hope they will help to lay bare the pragmatist secret.

When I first approached the domain of English philosophy I was struck with two facts.

On the one hand I searched in vain for a single philosopher who was counted among the great systembuilders of international renown. Of course H. Spencer at first glance seems quite an exception to the rule; but I am not sure whether he is after all an exception. Anyway the exception proves the rule.

On the other hand I was surprised to find so many bold and successful discoverers in the land of darkest philosophy, called metaphysics. It is true, part of these discoveries are still lying about like unused blocks of marble

—only waiting to be reared in place by the hand of the great architect. Taking my cue from the dedicatory lines of James's volume on *Pragmatism*, I will illustrate by the discovery of the principle of utility. Although John Mill was never able to prove the truth of his discovery, and had to wait for Charles Darwin to furnish the necessary premises, it is to my mind the one hypothesis which made possible the scientific treatment of ethics and thus rescued it from further futile speculation.

Likewise it is an English-speaking thinker who has discovered the personal equation in all our thought, our most pretentious critical and empiricist philosophies not excepted. Mr. James insisted more than twenty years ago that the difference between the believer in an invisible universe and the agnostic was a matter of "private personal appetite" (*Will to Believe*, p. 56); that "as a rule we disbelieve all facts and theories for which we have no use" (*Will*, p. 10); that "our non-intellectual nature does influence our conviction" (*Will*, p. 10); or that "pretend what we may, the whole man within us is at work when we form our philosophical opinions" (*Will*, p. 92). Even as early as the note attached to "Some Hegelisms," he began abundantly to scatter hints which if followed up would go to prove the truth of his hypothesis. He traces, for instance, Hegel's antithetical and synthetical reasoning to a peculiar kind of abstraction-trance. But although Mr. James has never elaborated his great discovery into a psychology of metaphysics, yet we find in his latest book the hypothesis now to have grown into a theory about our method of knowing—pragmatism. In the present stage of its development he is now ready to charge the professional philosophers with "a certain insincerity in our philosophical discussions" inasmuch as "the potentest of all our premises is never mentioned," temperament being no conventionally recognized reason (*Pragm.* pp. 6, 7).

Now Mr. James distinguishes two kinds of mental temper and accordingly two types of philosophers: the tough-minded or the empiricist and the tender-minded or the intellectualist. In which of the two classes shall we place the pragmatist? Since the tough-minded are "the men whose Alpha and Omega are facts" (*Pragm.*, p. 262) the pragmatist appears to be one of them because "pragmatism is uncomfortable away from the facts" unlike intellectualism which "is comfortable only in the presence of abstractions" (*Pragm.*, p. 76). Accordingly pragmatism must be a metaphysical attitude closely akin to empiricism. If a metaphysical attitude is "our individual way of just seeing and feeling the total push and pressure of the cosmos" (*Pragm.*, p. 4) Mr. James appears to consider it the preference of each one of us in reacting upon experience as a whole, in short, our private affair.

But it is well to be cautious in dealing with pragmatism because besides being a metaphysical attitude pragmatism is still something else. It is also a theory of knowledge newly discovered within physiological psychology, from which there has been evolved a method to judge about ideas and hypotheses in a scientific impersonal way. "On pragmatic principles" or to differentiate more sharply, as pragmatic scientists in contrast with the pragmatic metaphysicians, "we cannot reject any hypothesis if consequences useful to life flow from it. Universal conceptions as things to be taken account of may be as real for pragmatism as particular sensations" (p. 273). "We cannot, therefore, methodically," i. e., as pragmatic scientists, "join the tough minds in their rejection of the whole notion of a world beyond our finite experience." Thus the absolute edition of the world is "indispensable at least to certain minds, for it determines them religiously, being often a thing to change their lives by" (*Pragm.*, p. 266). Or, since there are people who interpret Walt Whitman's poem

"To You" monistically, "pragmatism" let me again differentiate by the definition, as a scientific attitude "must respect this way, for it has massive historic vindication. But pragmatism"—let me modify again,—as a scientific attitude "sees another way to be respected also, the pluralistic way" (*Pragm.*, p. 276). The pragmatic scientist, then, is not only tolerant, but also a defender of metaphysical hypotheses, even if rationalistic, "so far as these redirect you fruitfully into experience." From this point of view Mr. James may justly object to identifying pragmatism with positivistic tough-mindedness, to supposing that "it scorns every rationalistic notion as so much jabber and gesticulation" (*Pragm.*, p. 266).

This tolerance of the pragmatic scientist, then, allows two provisional formulations of *ultimate* truth, the one excluding the other as its contrary, and thus doing away with the logician's law of identity. This cannot be Mr. James's meaning. It smacks too much of Renan's phantasmagoria of the Absolute who makes us live by illusions. The *Varieties of Religious Experience* suggest rather that there may be several relative truths of equal validity (though exclusive of each other) because there are several types of mental constitution among men varying according to race, environment and temperament. I would like to call them emotional-volitional truths in distinction from the intellectual truths of physics or chemistry; and I would define them as teleological or spiritual truths in distinction from the mechancal truths which fit the outer aspect of our experience.

These teleological truths are expressed in the imaginative language of the personal will and, it is true, are valid only for the individual. They turn from relative into ultimate truths only by act of the individual will, or to give Kant some credit in this matter of scientific pragmatism, by act of "the practical reason." As pragmatic

scientists we may thus affirm what Bagehot denies, that the intensity of the emotion is a sign of truth although it is precisely strongest in those points in which men differ most from each other. John Knox, for instance, was just as right in his anti-catholicism as Ignatius Loyola in his anti-protestantism (James, *Psych.,* Vol. II, p. 308).

But Mr. James may insist that Kant, staking out the boundary line between metaphysics and scientific philosophy, is *"ein überwundener Standpunkt"* for the pragmatist. Well, even if the pragmatist is out of harmony with Kant—even if the former sees in experience but a universal flux, even if truth is caught only in the verification process, I cannot understand why he does not differentiate between the verification process of general mechanical truths and of individual teleological truths. The feeling of conviction attending the former differs from that of the latter. The former are based on the stable organization of our senses; the latter on the changing mood of our emotional-volitional nature. Their origin, then, being different, they constitute for me different classes of psychic phenomena. For even if I appreciate the great psychological discovery that Kant's practical reason sways even the function of conceiving, of fixing, holding fast to meanings—even if I admit that the "conceiving or theorizing faculty functions exclusively for the sake of ends that .....are set by our emotional and practical subjectivity" (*Will,* p. 117), I cannot yet see why we should not differentiate between truths when the one class has as its father the outer or space aspect of things and the other, the inner or teleological aspect; that they are children of the same mother "the powers of will" (*Will,* p. 140), that does not make them alike.

And it is for this difference in psychic origin and character that I have here introduced into my interpretation of pragmatism the distinction between the pragmatist as a

metaphysician who deals with his own individual teleological truths, and the pragmatist as a man of science who attends to the intellectual truths abstracted from the outer aspect, be it man or atom.

THE UTILITARIAN.

If Mr. James does not admit this distinction to be valid for him or anybody else that wants to understand him, I will appeal to the tolerance behooving a pragmatic scientist that he allow me for once the use of this hypothetical distinction; I should like to try whether the distinction will not "work" in probing deeper the psychic origins of pragmatism.

First, then, the pragmatic metaphysician avows himself to "agree with utilitarianism in emphasizing practical aspects" (*Pragm.*, p. 53). He is a creature of likes and dislikes, of abilities and inabilities which finally produce a number of postulates regarding God, freedom and immortality. He is more precocious than the scientist. The metaphysician tells us he has *always* had "a great mistrust of the pretensions of the gnostic faith." Not only does he "utterly fail to understand what a cognitive faculty, erected into the absolute, of being with itself as its object, can mean" (*Will.* p. 140); but neither can he fathom why we in our speculation, which the intellectualist demands of us, ought to "agree" with, or to "copy" the highest reality *without that any good would accrue to us* (*Prag.*, p. 234; *Journal of Phil.*, IV, 5, p. 130).

* * *

I do not know how early in life he began to mistrust the speculation of those who think they may conquer the Absolute by reasoning. I should not wonder, however, if we will be told in the autobiography which the discoverer of metaphysics as reflex action owes us, that in his boyhood the question *cui bono* was the one and all criterion of truth,

—a fan by which he sifted the wheat of his boyhood philosophy from the chaff of what the boy considered nonsense or fallacies urged upon him by home, church or school. It is safe to say that in his boyhood days he must have been a utilitarian, just as most of us were utilitarians when boys. Even John Mill, reading Bentham in Dumont's *Traité* discovered his principle of utility when he was scarcely more than a boy.

But it is not a boy's business to tackle the Absolute. All I have been able to learn about the Absolute inclines me to assume that it is a psychic experience which comes after the emotional storm and stress of puberty during the first critical half of adolescence. Under the influence of the Absolute a great many new ideas for a still subconscious system are acquired, and some old ones not without qualms pruned or entirely cut out. All this prepares the productive second half of adolescence in which youth struts about as a reformer (Mill, Tolstoy) or delivers himself of his *World as Will and Idea,* his *Phenomenology,* his *New Theory of Vision,* his *Sartor Resartus* and his *Will to Believe.*

For our present purpose it is not indispensable to determine which half of adolescence it was when Mr. James for the first time asked the question what use there would be for a God who is an absolute cognitive faculty. It is enough to see him testify (*Will,* p. 140) that the utilitarian attitude was ready made when later as a student of physiology and psychology he found the only lesson he could learn from these sciences to be one that corroborated the convictions acquired before. "From its first dawn," he continues in the passage referred to, "to its highest actual attainment we find that the cognitive faculty. . . . appears but as one element in an organic whole and as a minister to higher mental powers—the powers of Will." As evolution has saved John Mill's principle of utility from being

a mere metaphysical idiosyncracy, so "the theory of evolution is beginning to do very good service by its reduction of all mentality to the type of reflex action" (*Will*, p. 84).

THE EVOLUTIONIST.

It is true, however, the one sort of mentality which concerns us here most, metaphysics, is still awaiting its reduction to that type; but, suppose it had been done, we still would have to admit that the theory of evolution itself is nothing but a working hypothesis—a fact to which the pragmatic scientist will agree more readily than anybody else; for according to him "all our theories are instrumental, are mental modes of adaptation to reality" (*Pragm.*, p. 194). Moreover the theory of evolution seems to "work" with some people better than with others. There is apparently a type of mind which easily takes to the theory. Men like G. Bruno, Thomas Browne, J. Böhme, Lamarck, Hegel and Darwin are beautiful specimens of that type. Indeed there are evolutionists that are born so. But there are also other minds with whom the idea of evolution or becoming as ultimate truth does not agree. Witness Plato and his helpless struggle with the hypostatized concept of becoming. Witness Schopenhauer, Cuvier, Saint Meunier, Virchow and a great many other thinkers of modern times, especially Frenchmen. It is indeed a rare case to have a thinker combine in himself, as Goethe did, the plastic imagery of the artist and the dynamic type of thought of the evolutionist.

However, what is the dynamic type of thought? What is a born evolutionist? While studying the mental development of Darwin and A. R. Wallace, I found the discovery of the theory of evolution closely connected with a certain kind of the *regressus ad infinitum* in the temporal succession of similar animals. During his voyage on the "Beagle" Darwin at the adolescent stage, so rife with dis-

coveries, was "deeply impressed by discovering" this succession and could not explain it but "on the supposition that species gradually became modified." The subject was so "touched with emotion," as Mr. James would say (*Varieties of Rel. Exp.*, p. 422), that it "haunted" Darwin; and still at forty-nine he writes: "There is *a grandeur* in this view of life with its several powers having been originally breathed in a few forms, or into one, and that.... from so simple a beginning endless forms...have been and are being evolved" (*Origin of Species,* p. 370). I would like to call such an elated retrospect a time-trance in contradistinction to a space-trance such as Kant experienced on looking out into the endless expanse of the heavens. Both trances are fits of abstraction in which the difference of mental imagination disappears and the images fuse into unity.

In cases of the time-trance, the emotion of unity has the intellectual after-effect of a "supposition" of evolution. Darwin apparently testifies to this fusion of images when he writes at 35: "If we choose to let conjecture run wild, then animals....may partake of our origin in one common ancestor....we may be all *melted together*" (Darwin's *Life,* p. 368). At the same time he speaks of "the tree of life" or "coral of life" as a figure for the unity of all organic beings. And the haunting "supposition" was so "touched with emotion," so powerful a postulate, that Darwin spent a life-time to raise it from a working hypothesis to the rank of a scientific law.

If it were not for Goethe's *Urpflanze* and primal vertebra I would not know what more to say about the evolutionist type of mind. But the zootropic or cinematographic fusion of similar mental images as in Goethe, Henslow, in dreams and dreamy states (Binet, *Psychol. of Reasoning,* chap. IV) of mind have suggested to me further details concerning the matter.

We have to distinguish two kinds of fusion of similar images, the one a real, lasting fusion, the other a momentary, seeming one, probably.

First, there is going on within us a subconscious process, more or less automatic, similar to composite photography which stocks our memory with generic images. For these images man has invented names and in place of these images many a mind lacking them altogether uses the names as thought-symbols for reasoning.

Individuals further differ in two respects, first, in the extent of possible fusion. On the negative end of the series you may place Professor Wundt with his *Allgemeinbegriffe* which will not fuse at all; about the middle, Plato with his ideal generic images or some other artist with his types of abstract concepts; and at the positive end, Goethe.

Individuals differ, secondly, in the orderly coordination of the generic images. Goethe's primal plant seems to be an instance of unusual fusion as well as of thorough systematic coordination by resemblance. In minds of the type preeminently fitted to systematize, the products of fusion seem to become so well coordinated according to resemblance that Darwin's tree of life as mental coordination of generic images functions better than a perfect pedigree of genera and species arranged in temporal succession. Attention may easily run along its branches and, if shifting fast enough, melt together even the opposite species in their genus. It functions better than a pedigree because it is a net-work of pedigrees. Not only the pedigree of the whole animal or the plant has a place in this system, but also its parts, the leaves, or the bones have theirs, and that part which has the longest pedigree fuses later than the rest and includes the fusion of the rest. It produces not only the primal leaf but also the primal plant because the pedigrees of the remaining parts are finally fused in the longest pedigree which is that of the leaf.

But with the material at hand I am not so very sure that even in regard to Goethe's case I am not already discussing the momentary and seeming fusion, the second kind as we differentiated above. In some evolutionists, probably the larger number, the fusion is not permanent; it does not produce generic images which are so individualized as to constitute a new species. Usually when generic images rise into waking consciousness, they appear immovable, seemingly unchangeable, static composite photographs, however much they are subject to subconscious changes that follow upon new sense-experiences. But in some minds they seem to appear in the field of attention with such rapidity that the onlooking subject perceives naught but the continuous change of the kinematograph. Witness Goethe seeing his primal plant grow while walking in the botanical garden of Padua. Most evolutionists, however, have no such command over their subliminal mind as genius has. And if wē venture an explanation of dynamic thought along the line of fusion of images, we will have to assume that the process of momentary fusion is wholly subconscious in the average evolutionist. Then the subject would receive only conscious information that the fusion of a simple pedigree has been subconsciously accomplished; this information would come in a few word-symbols expressing the evolution of the whole genus and the origin of all species of that genus from out of one primal specimen. Witness Goethe at Venice realizing the evolution of the genus "bone" out of one primal vertebra.

Although fully aware of the tentative character of the details of the explanation here offered, yet, until further biographical analyses say otherwise, I will hold that it takes two things to make a born evolutionist: (1) the time-trance, and (2) the highly developed faculty of systematizing which coordinates generic images by resemblance into a net-work of temporal succession.

That we are on the right track, at least regarding the time-trance and its momentary fusion of images, appears to me the more certain when we consider the trance in which Gotama Buddha discovered the "chain of causation," Dante the "eternal wheels" of creation, Jacob Böhme the "principia" and Goethe the "chain of buckets." In Faust's vision of the macrocosm we read:

> "Here all things live and work and ever blending
> Weave one vast whole from Being's ample range
> Here powers celestial rising and descending,
> Their golden buckets ceaseless interchange;
> Their flight on rapture-breathing pinions winging,
> From heaven to earth their genial influence bringing,
> Through the wide whole their chimes melodious ringing."
> (Act I, Scene 1. Miss Swanwick's translation.)

The very incoherency of these different images testifies to the fact that the poet saw them at least for moments fuse in his inner vision and that he does not accurately describe the psychic phenomenon when he compares the content of the vision with a drama. The *dramatis personae* play their several parts without ever changing or fusing into one another. In like manner one has inaccurately spoken of Hegel's Punch and Judy Show of concepts. Hegel's dialectics is *not* a drama if we understand by it a succession of interactions by personalities of a static character; but it *is* a drama if drama means the evolution and involution of moral or immoral forces. Although hypostatized, Hegel's concepts fuse with one another and with the rapidity of the kinematograph or kaleidoscope change like the zoological or botanical species in the evolutionist's mind.

Hegel has a natural liking for things that move and change, and a dislike for things static. That his mental imagery worked that way, is to my mind most clearly laid bare in his lines written on a tour through the Bernese Oberland in 1796. Delighted with the sight of the water-

falls, he says that the onlooker, not able to fix his eyes on the ever changing, ever flooded out form of the waves, constantly perceives the same image and at the same time realizes that it is not the same (Rosenkranz's *Hegel, p.* 478). On the other hand, the glaciers and the rocks called forth no rapture, rather the reverse. These masses gave him nothing but the monotonous and at last tedious idea *"Es ist so."* Although he cannot help calling them "eternally dead," they do not call forth the time-trance in which he may look at things *sub specie aeternitatis.*

This delight in the fusion of things, in the Heraclitean universal flux seems most natural also to Mr. James; and most probably constitutes a metaphysical need or "craving" of his. It is only from this point of view that I am able to see a meaning in some appreciative lines on the Hegelian principle of negation, which is claimed to bring a propulsive force into our logic, and on the metaphysical program involved (*Varieties,* p. 459). "The objects of our thought now act within our thought, act as objects act when given in experience. They change and develop. They introduce something other than themselves along with them, and this other proves itself also to be actual. . . . The universe is a place where things are followed by other things that both correct and fulfil them." This program executed would give us a system of generalizations which would *not* differ from the Hegelian in its *dynamic form.*

THE EMPIRICIST WITH A SPIRITUAL VISION.

But such a system of experience would *indeed* differ from the Hegelian in its *content,* that is, the experience which the pragmatic metaphysician brings to his task.

Mr. James knows two kinds of experience: *sense experience* on the one side and *emotional-volitional* or *spiritual experience* on the other. His volume on *Varieties of Religious Experience* is devoted to a scientific description

of the way people have emotionally and volitionally experienced the world as a whole. The pragmatic scientist there demonstrates (1) that there are moments of emotional and volitional experience in which we realize more deeply than at other times the purpose and meaning of life; (2) that there are various degrees of intensity of this experience which we may call the spiritual or teleological vision; and (3) that the after-effect of the spiritual vision is often a lasting conviction or philosophy of life.

Years before the publication of the *Gifford Lectures*, Mr. James testified to having himself had some experience of the kind. Stating his belief that in cooperation with God's purposes must lie the real meaning of our destiny, and generalizing from what is true with him individually, he argues in his *Will to Believe*: "All men know it at those rare moments when the soul sobers down and leaves off .... insisting about this formula or that. In the silence of our theories we then seem to listen and to hear something like the pulse of Being beat" (p. 140). Or we read in his *Talks to Teachers* (p. 242): "The higher vision of an inner significance in what, until then, we had realized only in the dead external way, often comes over a person suddenly; and when it does so, it makes an *epoch* in his history."

When the higher vision came over Mr. James I am not able to tell. But that it made an *epoch* in his mental history, or if that is overstating the case—(some like the Rev. E. E. Hale never had a break in their inner development)—that the vision had a lasting after-effect upon our pragmatic metaphysician, we may infer from another statement about the value of the ontological vision, as he sometimes calls that experience. He says (*Will*, p. 74): "At such moments of energetic living we feel as if there were something diseased and contemptible, yea, vile, in theoretic grubbing and brooding."

But, Mr. James still believes in theoretic grubbing and brooding; he is still a philosopher, and, what is more astonishing, he is still a pluralist although he himself admits that "mystical states of mind in every degree are shown by history, usually though not always, to make for the monistic view" (*Pragm.* p. 151).

He accounts for the Hindu and Buddhist belief in monism by the supposition that they are "afraid of more experience, afraid of life" (*Pragm.*, p. 292). The very tenor of this statement shows him altogether out of sympathy with the monistic after-effect of the spiritual vision. To justify his own hostile attitude toward Hegel the monist *par excellence,* he quotes Baron Bunsen writing to his wife.

"Nothing is near but the far; nothing true but the highest; nothing credible but the inconceivable; nothing so real as the impossible; nothing clear but the deepest, nothing so visible as the invisible, and no life is there but through death" (*Will,* p. 274).

To gain a broad historical basis and shed light upon a whole class of thinkers, Mr. James adds: "Of these ecstatic moments the *credo quia impossibile* is the classical expression."

Then he goes on to say that "Hegel's originality lies in his making their mood permanent. . . . and authorized to supersede all others—not as a mystical bath and refuge for feeling when tired reason sickens of her intellectual responsibilities (Thank heaven! that bath is always ready) but as the very form of intellectual responsibility." He scolds Hegel for reasoning as the mystical or spiritual experience dictates and seems to insist that we are in duty bound to use our intellect according to the second kind of experience, which we said he distinguishes from the emotional one, that is *sense-experience.* Now, sense-experience is nothing but the experience of mechanical things moving in space. Thus the pragmatic scientist will tell us that

ascribing an inner life to our dearest ones is not sense-experience, but a conclusion from analogy and thus a belief. As belief it belongs wholly to the emotional experience.

Like ordinary people, then, the pragmatic metaphysician is not a materialist who believes the world to be external motion of dead matter; neither is he satisfied with the mental reserve of men like Lotze, Renouvier and Hodgson. They, at an earlier stage of their development "promptly say that of experience as a whole no account can be given, but neither seek to soften the abruptness of the confession nor to reconcile us with our impotence" (*Will,* p. 74). On the contrary, he believes the world to be "an indefinitely numerous lot of eaches" (*Pragm.,* p. 264) and calls himself a pluralist. His view of life is based on the belief in the truth of the emotional experience as the inner aspect of things. And most naturally so (1) because he is aware that "the peace of rationality may be sought through ecstacy when logic fails" to give account of experience as a whole, and (2) because he constitutionally likes higher visions, ecstatic moments, ontological emotions "as a mystical bath and refuge for feeling." Since he does not reject this kind of experience and since no ecstatic moment is without its noëtic quality, some of the fundamental postulates of his philosophy must have had their origin in the higher vision. To return to a passage (*Will,* p. 140) which I have referred to before, "at those rare moments when the soul sobers down," when "we seem. . . . to hear something like the pulse of Being beat" it was borne in upon Mr. James, the metaphysician, at thirty-nine or earlier (1) that the dumb willingness to suffer and to serve this universe is more than all theories about it put together, (2) that God's being is external to, and sacred from ours, (3) that in cooperation with his purposes lies the real meaning of our destiny.

This spiritual experience implies the following metaphysical postulates as their automatic insight or after-effect.

1. Mr. James, the pragmatic metaphysician, believes in the reality of the inner aspect; the world is mental experience; Mr. James is an idealist so far at least, as the supremacy of the inner or psychic over the outer or mechanical aspect implies, or if you like a less indefinite or abstract term, he is a pan-psychist.

2. Mr. James believes that the essential root of human personality lies in a resolute moral energy. Personality is, therefore, first of all will, and Mr. James is accordingly a voluntarist.

3. He demands in the universe "a character for which our emotions and active propensities shall be a match" (*Psych.*, II, 313, 1882). He believes in a God who is also will, a will sacred from our own, who is in a way authority over us and wants our cooperation,—another personality adding his part to make up the universe. The phrase about "the dumb willingness to suffer and to serve this universe," betrays to my mind that the vision itself had identified God with the universe, that Mr. James knows from experience the emotion of unity with the universe which is monistic. However that may be, the after-effect is *not* monistic. Although Mr. James believes in one God for himself, one moral authority over himself, we cannot say he is a monotheist, we may rather apply the term "*henotheist*," which the historians of Semitic religions have fashioned to describe the religious status of the tribes of Israel before their various tribal Yahvehs were fused into the one national and world-god. Such conception of a limited God would leave room for other spiritual or non-spiritual organizations in which other personalities feel obliged to cooperate with their gods. It may even be that like two star-systems these different organizations pass

through each other and so cause all the trouble there is in this world of ours.

4. There being now two wills, the one sacred from the other, two willing entities which are only for short moments if ever allowed to fuse into one whole world, the possibility arises that Mr. James may, on account of additional experience of the outer aspect turn out to be either a dualist or a pluralist. He turned pluralist. In this sense we will have to anticipate future speculative results in which his liking for the hypothesis of a world-consciousness and his appreciation of Mr. Prince's *Dissociation of a Personality* may issue (*J. of Phil.*, vol. III, p. 657). So far he has expressed only his firm belief that our human experience is not the highest form of experience and that higher powers exist.

5. and last, these two wills, in a way sacred from each other, are in the spiritual vision experienced as moral wills, as personalities. This moral character makes the metaphysician an ethical voluntarist or personalist like Rudolph Eucken of Jena, B. P. Browne of Boston, L. W. Stern of Breslau.

THE EMPIRICIST AFTER AND IN SPITE OF THE SPIRITUAL VISION.

These, then, are the five fundamental postulates which James, the metaphysician, adheres to in spite of his "intellectual responsibilities." We will remember that "intellectual responsibilities" concern exclusively the external aspect of things which is reducible to mathematical equations and as such the object of science. But, beside being an empiricist in the new psychological sense, an empiricist listening to the spiritual vision, he claims to be empiricist of the old English school, after the vision is gone.

The empiricist, we are told, belongs to the tough-minded "whose Alpha and Omega are facts. Behind the bare

phenomenal facts. . . . there is nothing" (*Pragm.*, p. 262). The tough-minded accuse the tender-minded of taking the mere name of a fact and clapping it behind the fact as the ground of the fact (*Pragm.*, p. 262); they reject the notion of an "absolute edition of the world" or "eternal edition of the universe" (*Pragm.*, p. 273). So far as James, the empiricist, objects to a static, ready made ideal world beyond our finite experience, he is plainly an evolutionist and cannot help looking at the world as a dynamic flux. So far, however, as he insists on facts, he must mean both *sense-experience* and *spiritual experience*; the latter as the ultimate interpretation he imposes on sense-experience, allowing even the mystical bath some authority for this interpretation. * * *

Now, the ultimate interpretation of the universe, authorized by the rare moments of ecstasy, and sustained as an after-effect of them, is with Mr. James (1) *voluntaristic* and *ethical,* or *personal.* This metaphysical attitude is so enthusiastically taken by Mr. James that he cannot sympathize with the intellectualists who think they may know it all; and, in a kind of antipathy, he qualifies them as "guileless thorough-fed thinkers," as "well-fed philosophy-professors who have nothing to do but to speculate because a safe institution has taken care of them and looks out for their future welfare." To account for such antipathy one must assume that pragmatist and intellectualist differ in some of their instinctive reactions, in their likes and dislikes. James, the pragmatist, is so much in love with the volitional aspect of life that the only reason he can think of why anything should ever come into our world is that some one wishes it to be here (*Pragm.* p. 288). Says he: "It is demanded—demanded, it may be, to give relief to no matter how small a fraction of the world's mass. This is living reason and compared with it material causes and logical necessities are spectral things."

Mr. James endorses Carlyle's teaching who said: "Hang your sensibilities. . . .and get to work like men" (*Will,* p. 173). Conduct and not sensibility is the ultimate fact for his recognition. He cannot understand the willingness to act, no matter how we feel without the belief that acts are really good and bad. He cannot understand the belief that an act is bad without regret at its happening. He cannot understand regret without the admission of real genuine possibilities in the world (*Will,* p. 175). Convinced that the moral world is ultimate reality, he rejects a deterministic view of life (*Will,* p. 177).

I find it hard to understand Mr. James here, for I am myself rather inclined like Hegel and Renan to take the strictly dramatic point of view and treat the whole thing as a great unending romance which the spirit of the universe, striving to realize its own content, is eternally thinking out and representing to itself (*Will,* p. 170). But *two lines of thought* suggest themselves to me as likely to be helpful in getting at the secret of such mental constitution as that of the ethical voluntarist,—*boyhood philosophy* and *tribal ethics.*

In coming across the strange demand for the revival of a dualistic religion in James Mill and the final dualistic attitude of John Stuart Mill, it occurred to me that I had noticed the same reasoning in boys. The boy unconsciously interprets by his tribal ethics the behavior of the universe toward him. His ethics like the ethics of the primitive tribe which he onto-genetically repeats, demands justice —justice meaning that each party to the contract give the equivalent for value received.

The prophets of Israel are an example for such philosophizing in so far as they judge Yahveh's behavior towards Israel from their tribal ethics. A boy may still reason that way. But how is it possible that adult Anglo-Saxon thinkers of to-day should make the same postulate after phi-

losophy has flourished for so many centuries? Maybe it was because of tribal ethics again or because of the political conditions and ideals of their democratic surroundings that these men turned dualists.

We philosophers of continental Europe are descendants of people who have lived for ever so long under an aristocratic régime. We are used to autocratic, patriarchal, more or less arbitrary rule, and for that reason, it may be that we somehow outgrow boyhood-postulates when life teaches us better, and easily admit that we may not understand the wisdom of God's conduct towards us; we calmly conclude, it may be right after all or ecstatically proclaim the rationality of all being; we do not use at all the term justice in our dealings with the supreme ruler. Even in my "rare moments" I have never realized God except as the arbitrary master of my life whom I had better obey; but I would infer that in the "rare moments" of some Anglo-Saxon thinkers like the two Mills, S. S. Laurie, or Mr. James, God, however great his resources, is realized as their fellow-citizen, rather than their autocratic superior. He is like the chosen king of early Germanic society, or the official representative and leader of modern democracy.

* * *

If thus the tribal or democratic interpretation of the universe is made ultimate, it is only natural (2) that the empiricist turns *dualistic pluralist* as soon as he emotionally experiences human sufferings. Emotionally to experience human sufferings means for me that, when the animating mood comes over a man, he will reason from analogy to suffering personality by way of emotions closely coordinated with generic images of his own suffering body. Now every one who knows Mr. James will easily admit that his coordination of sympathetic reactions works more readily than that of many another professor or "philister" for that

matter. He scoffs at Leibnitz's feeble grasp of reality, and the optimism of present-day rationalism sounds just as shallow to his mind (*Pragm.*, p. 27). He sides rather with the anarchistic writer Morrison F. Swift who paints a dark picture of our civilized régime in *Human Submission.* And from his strenuous point of view, life "feels like a real fight—as if there were something really wild in the universe" (*Will*, p. 61); he cannot help taking "the universe to be really dangerous and adventurous" (*Pragm.*, p. 295).

* * *

It is well in keeping with the same point of view that James, the empiricist, reveals himself (3) to be an *active optimist.* The idea of God being "in difficulty" to use S. S. Laurie's phrase, challenges all that is chivalrous and noble in man to cooperation. Not being able to see why the very existence of an invisible world may not depend on the personal response which any one of us may make to the religious appeal; not knowing what the sweat and blood and tragedy of this life mean, unless they mean that God himself may draw vital strength and increase of very being from our fidelity; he feels that we, with all our idealities and faithfulnesses, are needed to redeem the universe (*Will*, p. 61). With the fighting spirit of the crusader and the adventurous Norseman, he likes the call and feels like "a happy-go-lucky anarchistic sort of creature" (*Pragm.*, p. 259). He violently dislikes anything like the consummation of progress. The white-robed, harp-playing heaven of our Sabbath-schools, the ladylike tea-table elysium represented in Spencer's *Data of Ethics* (*Will*, p. 167) awaken in him yearnings for Nirvâna and escape. On emerging from the spiritual Chautauqua into the dark and wicked world, he feels relieved. He is glad to take his chances again in the big outside worldly wilderness with all its sins and sufferings. The element of precipitousness, of

strength and strenuousness attracts him (*Talks,* p. 270). He not only likes the fight but is also sure of victory, conceiving as the ideal human state "not the absence of vice, but vice there, and virtue holding her by the throat" (*Will,* p. 167).

THE ANTI-INTELLECTUALIST.

A metaphysician who is thus seen to be *ethical voluntarist, dualistic pluralist* and *active optimist,*— who is all this by emotional-volitional or spiritual experience both of the mystical and the self-conscious kind,—such a metaphysician may be expected to be set heart and soul against the intellect claiming that it is able to find ultimate truth by brooding over sense-experience.

And, indeed, Mr. James is an anti-intellectualist and passionately so because his insight into the limitation of our intellect is "touched with emotion." In his spiritual moments of energetic living he has felt not only that "in cooperation with God's purposes. . . must lie the real meaning of our destiny," but also that it does not lie "in any chimerical speculative conquest of him, in any theoretic drinking of him up." He has felt "as if there were something diseased and contemptible, yea, vile, in theoretic grubbing and brooding." Therefore he takes very little stock in any kind of metaphysical speculation and thinks it "more than probable that our power of moral and volitional response to the nature of things will be the deepest organ of communication therewith we shall ever possess" (*Will,* pp. 74, 140).

Having so far traced his anti-intellectual empiricism back to the teleological vision, we might try to go farther back to the peculiarities of his *psycho-physical constitution.* Taking, then, the vision as the conscious completion of his mental constitution, we may seek the key to the secret in such a hypertrophy of his sensory-

motor area which we might expect to find in the Crusader, the Norman conqueror, the reformer, the great soldier, the administrator, the engineer, and in all people who think in terms of motion.* Going still further we may finally see a causal connection between his evolutionistic tendencies and the special structure of that brain area. That would account for the pragmatist's dislike of any static philosophy as expressive of the "inward remedilessness" of life's tragedies, for his dislike of verbal solutions, useless questions, and metaphysical abstractions; for his attitude of looking away from first things, principles, metaphysical categories, supposed necessities. It would account for his inability to understand "why from Plato and Aristotle downward philosophers should have vied with each other in scorn of the knowledge of the particular and in adoration of the general" (*Psych.*, I, p. 479).

These anti-intellectual tendencies pure and simple will, I suppose, not be difficult to interpret, as soon as experimental psychology is in a position to find out more about the psycho-physical make-up of an individual pragmatist than Edouard Toulouse established regarding the intellectualist Zola (Emile Zola, *Enquête médico-psychologique*, I, Paris, 1896).

But it is more difficult to account for a certain bitterness of feeling that pervades many of the statements against the believer in metaphysical speculation. If the pragmatic scientist recognizes the existence of the tender-minded type of philosophers and accounts for their favorite intellectual view of life by the hypothesis that all mentality, including every philosophy, is reflex-action, would one expect the pragmatic metaphysician to turn dogmatist and refuse his opponents the right of existence? Instead of showing pragmatic tolerance, Mr. James represents Renan

*I wonder whether the percentage of infinitive nouns used is not far greater with the dynamic philosopher than with the static type!

as "playing the coquette between the craven unmanliness of his *Philosophic Dialogues* and the butterfly optimism of his *Souvenirs de jeunesse*" (*Will*, p. 171). He considers the theologian's deduction of God's attributes but a "shuffling and matching of pedantic dictionary adjectives, aloof from morals, aloof from human needs" (*Var.*, p. 446). Even if "from the point of view of practical religion the metaphysical monster which they (the theologians) offer to our worship is an absolutely worthless invention of the scholarly mind" (*Var.*, p. 477), even if to know that "his (God's) happiness is anyhow absolutely complete" does not "assist me to plan my behavior," (*Var.* p. 445),—why may not such theology be "touched with emotion," be, as he admits in the very flagrant case of Cardinal Newman, worth something to minds of a type different from the pragmatist's? And, since we as pragmatic scientists must respect any philosophy as necessary reflex-action of the individual author, even the philosophy of the well-fed professor, we have no longer any right to complain of the verbal and empty character of philosophy (*Pragm.*, p. 100), because it is not verbal and empty for the individual author and his sympathizers.

Thus the bitter feeling and the intolerance displayed against the intellectualist will be a puzzle to me as long as we are not allowed a detailed account of the mental development of Mr. James, the metaphysician. Or does the solution lie in our pragmatist's refusal to distinguish between the scientific treatment and the teleological treatment of the world about us? Take for instance his rejection of modern sociology as causing the most pernicious and immoral fatalism because it talks about laws and predetermined tendencies without giving credit to the free moral individuality! But is it not a fact that the universe behaves according to certain unchanging rules? And does not man do well to discern these iron-bound rules and

regulations and to govern his life accordingly? I expect that this is true pragmatism, but that does not mean, that there may not be possible a wider outlook and another interpretation of life, comprising the world about us and within us: the emotional-volitional or spiritual interpretation!

Therefore I repeat my petition addressed above to Mr. James, the pragmatist, that he consider,

1. whether one had not better, for justice's sake, keep the business of the pragmatic scientist, who reduces all systems of experience to reflex-action, apart from that of the pragmatic metaphysician, who evolves a system of ethical voluntarism for himself and his sympathizers;

and 2. whether he had not better distinguish between intellectual truths of the outer aspect and spiritual truths imposed upon both the outer and inner aspect of life. Science would then uphold her old claim of being true for all; and metaphysics, being a private affair, would rank with *beiles letters* and theology and be held fit for the few that sympathize, or can make Lipps's *Einfühlung* with the author.

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P. S. I am not one of Professor James's pupils. Nevertheless I have sufficient reason not only to respect but also to admire the man, the writer and the scientist. I hope, however, that the article shows me unwilling "to rest in admiration" like an intellectualist before his Absolute,—an attitude which would be anathema with the pragmatist. Or to be plain, this small contribution to the history of philosophy is meant to help along the scientific treatment of matters philosophic.

Now every one of my readers is in the lucky position to further the same cause. All I have been able to suggest for the interpretation of Mr. James's philosophy has come to me from the analysis of many autobiographical documents. To understand a hundred thinkers of the past takes the intimate knowledge of a thousand living ones who are willing to use a little introspection and to jot down a few fragmentary statements. The reader will therefore greatly oblige me if he writes about those periods in his past life when he was perplexed over the meaning of his own life and the world about him; likewise about the times and occasions, if any, in which a former view of his relation to God and fellowmen was confirmed, or a new prospect opened before his inner vision. It would be important to add the age at the time of the experience, to state the circumstances that may have brought it on, and to describe the peculiar feelings that accompanied it.

THE PSYCHOLOGICAL ORIGIN OF RELIGION.

I. THE ORIGIN OF THE IDEAS OF GHOSTS, NATURE-BEINGS AND CREATORS.

IT has been the habit of most students of the origin of religion to concern themselves exclusively with the origin of the god-idea, as if belief in the existence of gods was identical with religion. They have ignored its other essential components, the motives and the feelings. But the limitation of the problem of origin to that of the god-idea is not entirely amiss. For there are neither specifically religious motives, nor specifically religious feelings. Any and every human need and longing may, at some stage or other, become a spring of religion, and conversely the feelings and emotions met with in any form of religion appear also in non-religious experience. As to the practical means of securing the favor of the gods, it is agreed that they were at the beginning essentially the same as those men were already in the habit of using in their relations with their fellow-men. It is the power with which man thinks himself in relation, and through whom he endeavors to secure the gratification of his desires, which alone is distinctive of religious life. And so the origin of the idea of gods, though not identical with the origin of religion, is at any rate its central problem.

All living savages known to us believe in ghosts, in spirits, and, perhaps, also in particular beings risen to the

dignity of gods. Whence these ideas of unseen personal beings? They may be traced to four independent sources.

(1) *States of temporary loss of consciousness—trances, swoons, sleep,* — seem in themselves sufficient to suggest to ignorant observers the existence of "doubles," i. e., of beings dwelling within the body, animating it, and able to absent themselves from it for a time or permanently. These alleged beings have been called "ghosts" or "souls."

(2) *Apparitions in sleep, in the hallucinations of fever, of insanity, or otherwise,* of persons still living or dead, seem also sufficient to lead to a belief in ghosts and in survival after death.

These two distinct classes of facts have no doubt cooperated in the production of the belief in ghosts, so that I shall refer to them in the sequel as the double origin of the ghost-belief.

Echoes and reflections in water and polished surfaces may have played a subsidiary rôle in the establishment or confirmation of the belief in ghosts and in spirits.

(3) *The personification of striking natural phenomena, tornadoes, thunder, sudden spring-vegetation.* The report of Tanner that one night Picheto (a North American chief), becoming much alarmed at the violence of a storm, got up, offered some tobacco to the thunder and entreated it to stop, should not excite surprise even though it should refer to the lowest savage. There is, of course, a long way between the sudden, temporary, and isolated personification of a natural phenomenon and the stable and generalized belief in the existence of personal agents behind visible nature. What we mean to assert here is merely that the systematized belief can have arisen out of the impulsive and occasional personification of awe-striking and frightening spectacles.

(4) Many persons have observed with surprise the apparition in young children of the problem of creation.

A child notices a curiously shaped stone and asks who made it. He is told that it was formed in the stream by the water. Then, suddenly, he throws out in quick succession, questions that are as much exclamations of astonishment as queries, "Who made the stream, who the mountain, who the earth?" *The necessity of a Maker is no doubt borne in upon the savage at a very early time,* not upon every member of a tribe, but upon some peculiarly gifted individual who imparts to his fellows the awe-striking idea of a mysterious, all-powerful, Creator. The form under which the Creator is imagined is, of course, derived from the beings with which his senses have made the savage familiar.

In what chronological order did the three kinds of unseen beings appear? Which came first, ghosts, nature-beings or creators? Our present knowledge does not provide an answer to this query. But this one may venture to affirm, they need not have appeared in the same order everywhere. It is conceivable that among certain groups of men the idea of a creator first attained clearness and influence, while elsewhere the idea of ghosts implanted itself before the others.

A question of greater importance to the student of the origin of religion is that of the lineage of the first god or gods, i. e., of the first unseen, personal, agents with whom men entered into relations definite and influential enough to deserve the name religion. Are they descended from ghosts, or are they nature-beings, or creators? I say "descended" from ghosts, for ghosts have not originally, all the qualities required of a divinity. They are at first hardly greater than men, though somewhat different. They must be magnified and differentiated from human beings if they are to generate the religious attitude. A comparison of the double-source of the ghost-belief with the source of the belief in nature-beings suggests the following re-

marks. Phenomena belonging to classes one and two necessarily lead to a belief in unseen *manlike* beings. The familiar relation of ghosts with the tribe, and also the great number of them, offer a definite resistance to the process of deification. It is otherwise with the personified nature-powers, for they are not necessarily, like ghosts, mere dead men in another life. In conceiving of an agent animating nature, the imagination is not limited to the thought of a particular human being, not even of a human being at all. The thunder might be the voice of some monstrous animal. The surpassing variety, the magnitude and magnificence of nature, stimulate the imagination into more original activity than the apparitions of men and women in dreams or in trances. For these reasons, if the choice was between ghosts and nature-beings, it would be advisable to favor the hypothesis that the first gods were derived from the spontaneous personification of striking natural events. But the idea of a creator probably takes precedence from ghosts and nature-beings in the making of religion, for a World-Creator possesses from the first the greatness necessary to the object of a cult, and the creature who recognizes a creator can hardly fail to feel his relationship to him. A Maker cannot, moreover, be an enemy to those who issue from him, but must, it seems, appear as the Great Ancestor, benevolently inclined towards his offspring. Incomparable greatness, creative power, benevolence, are as many attributes favorable to the appearance of a religion in the high sense which, as we shall see, W. Robertson Smith gives to the word.

The order in which appeared the three kinds of unseen agents is of considerable importance, for if, for instance, the ghost-belief was first, it seems unavoidable that ghosts should have been projected into natural objects and used to explain natural phenomena. It is a task for the historian of religion to trace the rise of the idea of God in its several

possible sources and to indicate in each particular case the contribution of each source to the making of the earliest gods.

II. THE ORIGINAL EMOTION OF PRIMITIVE RELIGIOUS LIFE.

The failure to recognize in religion three functionally related constituents—conation, feeling, and thought—is responsible for a confusing use of the term "origin." Some have said that religion began with the belief in superhuman, mysterious beings; others that it had its origin in the emotional life, and these usually specify fear; while a third group have declared that its genesis is to be found in the will-to-live. At this stage of our inquiry the reader realizes no doubt that these three utterances are incomplete, inasmuch as each one of them expresses either the origin, or the original form, of only one of the constituents of religion.

I have in the preceding section dealt with the origin of the god-idea. The space at my disposal does not allow me to say anything regarding the rise of the methods by which man entered in relation with the divine beings in whom he believes. For the same reason, I shall have to be very brief in dealing with the original emotional form of religion.

Two opposed opinions divide the field. The more widely held is that fear is the beginning of religion; the other, accepted by a small but weighty minority, finds its starting point in a "loving reverence for known gods." We shall have little difficulty in arriving at an understanding of the matter in which these two views, instead of opposing, supplement each other. The origin of the two emotions mentioned, fear and love, fall, of course, outside the limits of this essay, since they both existed before religion.

Hume's conclusion, that "the first ideas of religion arose. . . . from a concern with regard to the events of life and fears which actuate the human mind," is maintained

by most of our contemporaries. Among psychologists, Ribot, for instance, affirms that "the religious sentiment is composed first of all of the emotion of fear in its different degrees, from profound terror to vague uneasiness, due to faith in an unknown, mysterious, impalpable Power."[2] The fear-theory is well supported by two classes of interdependent facts observed, we are told, in every uncivilized people: (1) Evil spirits are the first to attain a certain degree of definiteness; (2) man enters into definite relations first with these evil spirits. If the reader will refer to *The Origin of Civilisation* by Lord Avebury (Sir John Lubbock), 3d ed., pp. 212-215, he will see there how widely true is the opinion expressed by Schweinfurth, "Among the Bongos of Central Africa good spirits are quite unrecognized, and, according to the general negro idea, no benefit can ever come from a spirit." In many other tribes good spirits are known, but the savage always "pays more attention to deprecating the wrath of the evil than securing the favor of the good beings." The tendency is to let the good spirits alone, because, being good, they will do us good of themselves, just as evil spirits do us harm unsolicited.

Shall we, then, admit the fear-origin of religion? Yes, provided it be understood (1) that fear represents only one of the three constituents of religion, (2) that is is not in virtue of a particular quality or property that fear is the primitive emotional form of religion, and (3) that this admission is not intended to imply the impossibility of religion having ever anywhere begun with aggressive or tender emotions Regarding the second reservation, it should be understood that the making of religion requires nothing found in fear that is not also present in other emotions. If tender emotions are not conspicuous at the dawn of religion, it is only because it so happens that the circumstances in which

[2] *The Psychology of the Emotions*, p. 309.

the least cultured peoples known to us live, are such as to keep fear in the foreground of consciousness. Fear was the first of the well-organized emotional reactions. It antedates the human species, and appears to this day first in the young animal, as well as in the infant. No doubt, before the protective fear-reaction could have been established, the lust of life had worked itself out into aggressive habits, those for the securing of food, for instance. But these desires did not, as early as in the case of fear, give rise to any emotional reaction possessing the constancy, definiteness, and poignancy of fear. The place of fear in primitive religion is, then, due not to its intrinsic qualities, but simply to circumstances which made it appear first as a well-organized instinct-emotion vitally connected with the maintainance of life. It is for exactly the same reason that the dominant emotion in the relations of uncivilized men with each other and, still more evidently so, of wild animals with each other, is usually that of fear.

When I say that fear need not have been the original religious emotion, I have in mind the possibility of groups of primitive men having lived in circumstances so favorable to peace and safety that fear was not very often present with them. This is not a preposterous supposition. Wild men need not, any more than wild animals, have found themselves so situated as to be kept in a constant state of fright. If the African antelope runs for its life on an average twice a day, as Sir Galton supposes, the wild horse on the South American plains, before the hunter appeared on his pastures, ran chiefly for his pleasure. Travelers have borne testimony to the absence of fear in birds inhabiting certain regions. But, it may be asked, would religion have come into existence under these peaceful circumstances? A life of relative ease, comfort, and security is not precisely conducive to the establishment of practical relations with gods. Why should happy and self-

sufficient men look to unseen, mysterious beings for an assistance not really required? Under these circumstances the unmixed type of fear-religion would never have come into existence. Religion would have appeared relatively late and, from the first, in a nobler form. In such peoples a feeling of dependence upon benevolent gods, regarded probably as creators and all-fathers, eliciting admiration rather than fear or selfish desire, would have characterized its beginnings. This possibility should not be rejected *a priori*.

The other theory is well represented by W. Robertson Smith. He denies that the attempt to appease evil beings is the foundation of religion. I quote: "From the earliest times religion, as distinct from magic and sorcery, addresses itself to kindred and frendly beings, who may indeed be angry with their people for a time, but are always placable except to the enemies of their worshipers or to renegade members of the community. It is not with a vague fear of unknown powers, but with a loving reverence for known gods who are knit to their worshipers by strong bonds of kinship, that religion, in the only sense of the word, begins."[3]

One may agree with Robertson Smith without denying that practices intended to protect oneself against evil spirits preceded the establishment of affectionate relations with benevolent powers. As a matter of fact, our author admits this fully. What he denies is that the attempt to propitiate, in dread, evil spirits, is religion. It cannot be doubted that the inner experience as well as the outer attitude and behavior of a person are substantially different when he seeks to conciliate a radically evil being than when he communes with a fundamentally benevolent one. Yet in both cases an anthropopathic relation with a personal being is established. In this respect, both stand opposed to magical behavior. This common element is so funda-

[3] *The Religion of the Semites*, p. 55.

mental that it seems to us advisable to make the name religion include both types of relation. And since they differ, nevertheless, in important respects, the phrases "negative religion" may be used to designate man's dealings with radically bad spirits, and "positive religion" his relations with fundamentally benevolent ones.

Positive religion is at first not at all free from fear. The benevolent gods are prompt to wrath, and cruelly avenge their broken laws. The more striking development of religious life is the gradual substitution of love for fear in worship. This is one more reason for not completely dissociating the propitiation of evil spirits from the worship of kindly gods.

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SOME AMAZING MAZES.

A SECOND CURIOSITY.

A phenomenon easier to understand depends on the fact that, in counting round and round a cycle of 53 numbers, $\sqrt{-1} = \pm 30$. (For $30^2 = 900 = 17 \cdot 53 - 1$.) This, likewise, may be exhibited in the form of a "trick." You begin with a pack of 52 playing-cards arranged in regular order. For this purpose, it is necessary to assign ordinal numbers to the four suits. It seems appropriate to number the spade-suit as 1, because its ace carries the maker's trade-mark. I would number the heart-suit 2, because the pips are partially cleft in two; the club-suit 3, because a "club," as the French term *trèfle* reminds us, is a trefoil; and the diamond-suit as 4 or 0, because the pips are quadrilaterals, and counting round and round a cycle of 4, $4 = 0$. But it is convenient, in numbering the cards, to employ the system of arithmetical notation whose base is 13. It will follow that if the cards of each suit are to follow the order 1 2 3 4 5 6 7 8 9 X J Q K, the king of each suit must be numbered as if it were a zero-card of the following suit. The inconvenience of this is very trifling compared with the convenience of directly availing oneself of a regular system of notation; for the exhibitor of the "trick" will have many a "long multiplication" to perform in his head, as will shortly appear. Another slight inconvenience is that the cycle of numeration must be fifty-three, or 4♠, which, or its highest possible multiple, must be sub-

tracted from every product that exceeds 4♠. It is to be remembered that ◇, ♠, ♡, ♣, are used as nothing but other shaped characters for 0, 1, 2, 3, respectively. Thirteen is the base of numeration, but fifty-three, or 4♠, is the cycle of numeration. I adopt ◇, rather then K, as the zero-sign in order to avoid denoting the king of diamonds by ♠ K, etc. In order to exhibit the trick in the highest style, the performer should have this multiplication table

◇ ♠	◇ ♡	◇ ♣	◇ 4	◇ 5	◇ 6	◇ 7	◇ 8	◇ 9	◇ 10	◇ J	◇ Q	
◇ ♡	◇ 4	◇ 6	◇ 8	◇ 10	◇ Q	♠ ♠	♠ ♣	♠ 5	♠ 7	♠ 9	♠ J	
◇ ♣	◇ 6	◇ 9	◇ Q	♠ ♡	♠ 5	♠ 8	♠ J	♡ ♠	♡ 4	♡ 7	♡ 10	
◇ 4	◇ 8	◇ Q	♠ ♣	♠ 7	♠ J	♡ ♡	♡ 6	♡ 10	♣ ♠	♣ 5	♣ 9	
◇ 5	◇ 10	♠ ♡	♠ 7	♠ Q	♡ 4	♡ 9	♣ ♠	♣ 6	♣ J	4 ♣ / ◇ ♡	4 8 / ◇ 7	
◇ 6	◇ Q	♠ 5	♠ J	♡ 4	♡ 10	♣ 3	♣ 9	4 ♡ / ◇ ♠	4 8 / ◇ 7	5 ♠ / ♠ ◇	5 7 / ♠ 6	
◇ 7	♠ ♠	♠ 8	♡ ♡	♡ 9	♣ ♣	♣ 10	4 4 / ◇ ♣	4 J / ◇ 10	5 5 / ♠ 4	5 Q / ♠ J	6 6 / ♡ 5	
◇ 8	♠ ♣	♠ J	♡ 6	♣ ♠	♣ 9	4 4 / ◇ ♣	4 Q / ◇ J	5 7 / ♠ 6	6 ♡ / ♡ ♠	6 10 / ♡ 9	7 5 / ♣ 4	
◇ 9	♠ 5	♡ ♠	♡ 10	♣ 6	4 ♡ / ◇ ♠	4 J / ◇ 10	5 7 / ♠ 6	6 ♣ / ♡ ♡	6 Q / ♡ J	7 8 / ♣ 7	8 4 / ◇ ♡	
◇ 10	♠ 7	♡ 4	♣ ♠	♣ J	4 8 / ◇ 7	5 5 / ♠ 4	6 ♡ / ♡ ♠	6 Q / ♡ J	7 9 / ♣ 8	8 6 / ◇ 4	9 ♣ / ♠ ♠	
◇ J	♠ 9	♡ 7	♣ 5	4 ♣ / ◇ ♡	5 ♠ / ♠ ◇	5 Q / ♠ J	6 10 / ♡ 9	7 8 / ♣ 7	8 6 / ◇ 4	9 4 / ♠ ♡	10 ♡ / ♡ ◇	
◇ Q	♠ J	♡ 10	♣ 9	4 8 / ◇ 7	5 7 / ♠ 6	6 6 / ♡ 5	7 5 / ♣ 4	8 4 / ◇ ♡	9 ♣ / ♠ ♠	10 ♡ / ♡ ◇	J ♠ / ♡ Q	

by heart in which I have been forced to put 10 in place of x most incongruously simply because I am informed that the latter would transcend the resources of the printing-office.

Yet I do it quite passably without possessing that accomplishment. In those squares of the multiplication-table where two lines are occupied, the upper gives the simple product in tridecimal notation, and the lower the

remainder of this after subtracting the highest less multiple of fifty-three, i. e., of 4♠.

In order to exhibit the trick, while you are arranging the cards in regular order, you may tell some anecdote which involves some mention of the numbers 5 and 6. For instance, you may illustrate the natural inaptitude of the human animal for mathematics, by saying how all peoples use some multiple of 5 as the base of numeration, because they have 5 fingers on a hand, although any person with any turn for mathematics would see that it would be much simpler, in counting on the fingers, to use 6 as the base of numeration. For having counted 5 on the fingers of one hand, one would simply fold a finger of the other hand for 6, and then make the first finger of the first hand to continue the count. The object of telling this anecdote would be to cause the numbers 5 and 6 to be uppermost in the minds of the company. But you must be very careful not at all to emphasize them; for if you do, you will cause their avoidance. The pack being arranged in regular sequence, you ask the company into how many piles you shall deal them, and if anybody says 5 or 6, deal into that number of piles. If they give some other number, manifest not the slightest shade of preference for one number of piles over another; but have the cards dealt again and again, until you can get for the last card either ♠x, that is, the ten of the second suit, (i. e., suit number one; since the first suit is numbered ◇, or zero), or ♡4, the four of the third suit, or ♠6, or ♡8. If you cannot influence the company to give you any of the right numbers, after they have ordered several deals, you can say, "Now let me choose a couple of numbers," and by looking through the pack, you will probably find that one or other of those can be brought to the face of the pack in two or three deals. For every deal multiplies the ordinal place of each card by a certain number, counting round and round a cycle of 53. And this

multiplier is that number which multiplied by the number of piles in the deal gives +1 or −1 in counting round and round the cycle of 53. For it makes no difference to which end of the pack the card is drawn. After each deal the piles are to be gathered up according to the same rule as in the first "trick," except that the first pile taken must not be the one on which the 52nd card fell, but the one on which the 53rd would have fallen if there had been 53 cards in the pile. The last deal having been made, you lay all the cards now, backs up, in 4 rows of 13 cards in each row, leaving small gaps between the 3rd and 4th and 6th and 7th cards counting from each end, thus:

1	2	3	4	5	6	7	8	9	10	J	Q	K
K	Q	J	10	9	8	7	6	5	4	3	2	1

The object of these gaps is to facilitate the counting of the places from each end, both by yourself and by the company of onlookers. If the first or last card is either ♠ x or ♡ 4, the first card of the pack will form the left-hand end of the top row, and each successive card will be next to the right of the previously laid card, until you come to the end of a row, when the next card will be the extreme left-hand card of the row next below that last formed. But if the first or last card is either ♠ 6 or ♡ 8, you begin at the top of the extreme right-hand column, and lay down the following three cards each under the last, the fifth card forming the head of the column next to the left, and so on, the cards being laid down in successive columns, passing downward in each column, and the successive columns toward the right being formed in regular order.

You now explain to the company, very fully and clearly, that the upper row consists of the places of the diamonds; and you count the places, pointing to each, thus "Ace of diamonds, two of diamonds, three; four, five, six; the

seven, a little separated, the eight, nine, and ten, together; then a little gap, and the knave, queen, king of diamonds together. The next row is for the spades in the same regular order, from that end to this," (you will not say "right" and "left," because the spectators will probably be at different sides of the table,) "next the hearts, and last the clubs. Please remember the order of the suits, diamond," (you sweep your finger over the different rows successively) "spades, hearts, and clubs. But," you continue, "those are the places beginning at *that*" (the upper left-hand) "corner. In addition, every card has a *second* place, beginning at *this* opposite corner," (the lower right-hand corner.) "The order is the same; only you count backwards, toward the right in each row; and the order of the suits is the same, diamonds, spades, hearts, clubs; only the places of the diamonds are in the bottom row, the places of the spades next above them, the places of the hearts next above them, and the clubs at the top. These are the regular places for the cards. But owing to their having been dealt out so many times, they are now, of course, all out of both their places." You now request one of the company (not the least intelligent of them,) simply to turn over any card in its place. Suppose he turns up the fifth card in the third row. It will be either the ♡3 or ♠J. Suppose it is the former. Then you say, "Since the three of hearts is in the place of the five of hearts, counting from *that* corner, it follows *of course*" (don't omit this phrase, nor emphasize it; but say it as if what follows were quite a syllogistically evident conclusion,) "that the five of hearts will be in the place of the three of hearts counting from the opposite corner." Thereupon, you count "Spades, hearts: one, two, three," and turn up the card, which, sure enough, will be ♡5. "But," you continue, "counting from the first corner, the five of hearts is in the place of the knave of spades, and accordingly, the

knave of spades will, of course, be in the place of the five of hearts, counting from the opposite corner." You count, first, to show that ♡ 5 is in the place of ♠ J, and then, always pointing as you count, and counting, first the rows, by giving successively the names of the suits, "diamonds, spades, hearts," and then the places in the row, "one, two, three, four, five," and turning up the card you find it to be, as predicted, the ♠ J. "Now," you continue, "the knave of spades is in the place of the nine of spades counting from the first corner, so that we shall necessarily find the nine of spades in the place of the knave of spades counting from the opposite corner." You count as before, and find your prediction verified. [I will here interrupt the description of the "trick" to remark that the number of different arrangements of the fifty-two cards all possessing this same property is thirty-eight thousand three hundred and eighty-two billions (or millions squared), three hundred and seventy-six thousand two hundred and sixty-six millions, two hundred and forty thousand, $= 6 \times 10 \times 14 \times 18 \times 22 \times 26 \times 30 \times 34 \times 38 \times 42 \times 46 \times 50$, not counting a turning over of the block as altering the arrangement. But of these only one arrangement can be produced by dealing the cards according to our general rule. Either of the four *simplest* arrangements having the property in question will be obtained by first laying out the diamonds in a row so that the values of the cards increase regularly in passing along the row in either direction, then laying out the spades in a parallel row either above or below the diamonds, but leaving space for another row between the diamonds and spades, their values increasing in the counter-direction to the diamonds, then laying out the hearts in a parallel row close upon the other side of the diamonds, their values increasing in the same direction as the spades, and finally laying out the clubs between the

diamond-row and the spade-row, their values increasing in the same direction as the former.

Not to let slip an opportunity for a logical remark, let me note that, *in itself considered*, i. e., regardless of their sequence of values, any one arrangement of the cards is as *simple* as any other; just as any continuous line that returns into itself, without crossing or touching itself, or branching, is just as simple, *in itself*, as any other; and relatively to the sequence of values of the cards, only, the arrangement produced in "trick," in which the value of each card is i times the ordinal number of its place, where $i = \pm\sqrt{-1}$, is far simpler than the arrangement just described. But in calling the latter arrangement the "simpler," I use this word in the sense that is most important in logical methodeutic; namely, to mean more facile of human imagination. We form a detailed icon of it in our minds more readily.]

You now promptly turn down again the four cards that have been turned up (for some of the company may have the impression that the proceeding might continue indefinitely; and you do not wish to shatter their pleasing illusions,) and ask how many piles they would like to have the cards dealt in next. If they mention 5 or 6, you say, "Well we will deal them into 5 and 6. Or shall we deal them into 4, 5, 6? Or into 2 and 7? Take your choice." Which ever they choose, you say, "Now in what order shall I make the dealings?" It makes no difference. But how the cards are to be taken up will be described below. After gathering the cards in the mode described in the next paragraph, deal them out, *without turning the cards up*. [I have never tried what I am now describing; but for fear of error, I shall do so before my article goes to press.] After that, you say, "Oh, I don't believe they are sufficiently shuffled. I will milk them." You proceed to do so. That is, holding the pack backs up, you take off the

cards now at the top and bottom, and lay them backs up, the card from the bottom remaining at the bottom; and this you repeat 25 times more, thus exhausting the pack. Many persons insist that the proper way of milking the cards is to begin by putting the card that is at the back of the pack at its face; but when I speak of "milking," I mean this *not* to be done. Having milked the pack three times, you count off the four top cards (i. e., the cards that are at the top as you hold the pack with the faces down,) one by one from one hand to the other, putting each card above the last, so as to reverse their positions. You then count the next four into the same receiving hand, *under* the four just taken, so that their relative positions remain the same. The next four are to be counted, one by one, upon the first four, so that their relative positions are reversed, and the next four are to be counted into the receiving hand under those it already holds. So you proceed alternately counting four to the top and four to the bottom of those already in the receiving hand, until the pack is exhausted. You then say, "Now we will play a hand of whist." You allow somebody to cut the cards and deal the pack, as in whist, one by one into four "hands," or packets, turning up the last card for the trump. It will be found that you hold all the trumps, and each of the other players the whole of a plain suit.

I now go back to explain how the cards are to be taken up. If it is decided that the cards are to be dealt into 5 and into 6 piles, (the order of the dealing always being immaterial,) you take them up row by row, in consecutive order, from the upper left-hand to the lower right-hand corner. If they are to be dealt into 4, 5 and 6 piles, or into 2 and 7 piles, in any order, you take them up column by column, from the upper right-hand to the lower left-hand corner. The exact reversal of all the cards in the pack will make no difference in the final result. They may also be taken up in columns

and dealt into piles whose product is 14 or 39 (as, for example, into 2 piles and 7 piles, or into 3 piles and 13 piles). They may be taken up in rows and dealt into any number of piles whose product is thirty, or, by the multiplication table is ♡4. The following are some of the sets of numbers whose products, counted round a cycle of 53, equal 30: 6·5; 17·8; 7·5·4·4; 9·7·3; 9·8·7·7; 9·6·6·5; 9·9·5·4; X·8·7; X·9·8·7·6; J·J·2; J·8·4·4; J·5·5·3; Q·X·X·4; Q·X·8·5; Q·7·7·6; K·K·3; ♠X·♠X·4 (decimally, 23·13·4); ♠6·♠4·6; ♠5·♢9·♢X.

The products of the following sets count round a cycle of 53 to $-30=23$; 4·♠6; 2·7·K; K·Q·X; 8·6·6; 9·8·4; X·X·5; Q·J·7; Q·Q·2; 5·5·5·4; 6·4·4·3; X·9·7·5; J·7·6·2; 11·7·4·3; 13·X·6·2; 13·8·5·3; 7·6·5·5·3; 7·7·7·5·4; 9·7·5·5·2; 11·6·5·4·3; 9·8·8·5·4·4; 8·8·7·7·4·4; 11·8·7·7·2·2; 12·11·9·8·7·6.

The products required to prepare the cards for being laid down column by column are ♠6, decimally expressed, 19; and ♡8, decimally expressed, 34.

The following are some of the sets of numbers whose continued products are 19: 9·8; Q·6; 5·5·5; 6·4·3; J·7·3; 13·6·5; 13·10·3; 8·7·6·4; 9·9·8·6; J·9·5·4; 11·10·9·2; 12·8·7·7; 13·10·8·7; 9·8·8·5·4; 10·7·7·6·5; 10·10·10·10·2; 12·7·7·5·5; 7·4·4·4·3; 13·7·4·4·4·4·4·4; 4·4·4·4·4·4·4·4·4·4·3. The following are sets of numbers whose continued product is 34: ♠4·2; ♠X·K; 29·3; 7·5·4; 9·3·♠♡; 9·9·5; X·7·2·; J·8·4; Q·X·X; 17·11·5; 17·12·9; 19·13·4; 23·11·6; 23·13; 23·17·7; 41·3·2; 5·5·4·4·3; 9·7·7·6·3; 8·6·5·5; 9·9·7·7·2; 13·13·7·2; 17·12·9; 8·4·4·4·4; 2·2·2·2·2·2·2·2·2·2·2·11·10·7·5; 13·12·9; 23·13.

This "trick may be varied in endless ways. For example, you may introduce the derangement that is the inverse of milking. That is, you may pass the cards, one by one, from one hand to the other, placing them alternately att he top and the bottom of the cards held by the

receiving hand. Twelve such operations will bring the cards back to their original order. But a pack of 72 cards would be requisite to show all the curious effects of this mode of derangement.

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A DIALOGUE BETWEEN AN IDEALIST AND A NATURALIST.

NATURALIST: So you think that if I had paid sufficient attention to the teachings of pure idealism I would have gladly adopted it as my philosophical creed. You say that most professional philosophers, and many prominent scientific thinkers, physicists and even biologists, have found idealism to afford the most satisfactory interpretation of nature. I readily admit that materialistic and mechanistic views, so long in the ascendant among naturalists, are superficial and fictitious, and have definitely proved to be untenable. Nevertheless the duality of body and mind, under the name of psycho-physical parallelism, is still widely maintained by thoughtful psychical as well as physical investigators. This proves that no kind of scientific monism has yet decisively triumphed, and that the momentous contention between realistic idealism and realistic naturalism is far from being settled.

The vexed question, I think, turns upon whether body is rightly conceived as a mere appearance in mind, or whether, on the contrary, mind itself is an outcome of bodily activity. Are we, all in all, products of mind; or the reverse, are we, all in all, products of bodily organization? This seems to me the decisive question, whose correct answer will disclose for good our true position in this world, of which we are as yet by no means certain, and will serve us as supreme guidance for rational con-

duct in life, at present in some respects still irrationally erratic.

Idealist. It seems to me almost impossible not to recognize, when once clearly pointed out, that the content of consciousness, composed, as it is, exclusively of mental phenomena, is all we are actually aware of. It is obviously our only source of information. Moreover we move and act entirely within its purely mental sphere among its mental representations, urged thereto by mental feelings. We get to know ourselves, and what is called the external world solely through conscious or mental manifestation, through feelings, sensations, perceptions, conceptions and emotions. Cherished memories, exalted imaginings, all manner of ideals, consist altogether of modes of consciousness. Nature, in fact, has her whole being in consciousness. Is not the nature you seem outwardly to perceive the very identical nature you are inwardly aware of? Her densest bodies, her so-called material constituents, are one and all of purely conscious or mental consistency. They are all composed of sensations or percepts, of nothing but feelings of resistance and visions of shaded and colored forms, outcomes of mind's activity. Howsoever solid-seeming, however much outspread in space, and conceived as enduring in time, all we are conscious of as nature melts impalpably into that universal spiritual solvent known as mind. Nature, its bodily appearances all included, is then clearly out and out a product of mental activity.

Nat. It must be conceded that what you say of our vision of nature is true to a great extent, so far as such vision is concerned, and it is also deeply significant. However, as a complete view of nature, it is contrary to what mankind in general has at all times believed, and contrary also to what you and all idealists are relying upon as guidance for conduct in life. Idealism offers itself as a consistent, all-comprising conception of nature. Wholly

mind-woven as it is, it entices its votaries to spurn the firm ground of actual experience, and to soar on wings of fancy to an empyrean filled with visions of all manner of ideal perfections. Such idealistic speculations encounter in their transcendent flight no imperatively resisting obstacles that force them profitably into definite salutary channels. They create for themselves an all but resistless medium by taking uncertain conceptual shadows for the realities which cast them, enabled thereby to roam at will in a chimerical world of thought-engendered fictions.

As to the directly perceptible world, idealism entirely volatilizes it into intangible mental phenomena, or into complete vacuity. Its most eminent champion, the good and great Bishop Berkeley, was consistently led by his logical bent to the startling conclusion, that each time the world is perceived, each time it appears pictured in an individual mind or spirit, it is newly created, and each time the eyes are shut it is again annihilated. Such a stupendous marvel presupposes an ever reiterated divine fiat; in fact a creation and myriadfold recreation of perceptible nature out of nothing. This would, indeed be necessarily the case, if perceptible nature had no other existence, save in the mind of the percipient actually aware of it; this means if perceptions, as Berkeley believed, were indeed identical with real being. And taking for granted an omnipotent creator, as Berkeley, the theologian, was bound to do, why could not such almighty power create ever anew the vision of nature in each of us whenever we open our eyes? But quite apart from theological speculations it may be safely asserted that our vision of nature is actually annihilated whenever we shut our eyes, and recreated whenever we reopen them.

Contemplate this most familiar and undeniable occurrence and you will find it whenever and in whomsoever it occurs to be a creative marvel more wonderful by far

than anything currently taught about creation. Here a most subtile, light-woven influence works its secret charm upon our open eyes, and lo! instantly, magically we are conscious of the whole wide form-filled expanse of the great outside world. Idealism hardly touches upon the secret of this ever renewed creation of the visible world, providentially ready to meet and satisfy our needs and desires. And how pitiously dependent are we from moment to moment on what is offered by sense-revealed nature, wherewith to gratify our wants, and to realize our aspirations.

Id. Is it not quite obvious here, that pre-existing mental endowment underlies the sudden appearance of what is called the external world? If it did not pre-exist in mind it could not possibly come into existence by so trifling an action on our part as the opening of our eyes, an action moreover entirely subject to capricious volition. It would indeed be nothing short of a myriadfold most stupendous miracle if an intangible momentary influence affecting our eyes from outside were to carry with it the entire external world ready-made. Instead of having recourse with Berkeley to the miraculous intervention of an ubiquitous theological agency, in order to explain the ever renewed creation of the percipient's vision of an external world, it is far more simple and convincing to conclude that on opening our eyes this vision is flashed into awareness by the activity of the percipient's own mind, in which it has its permanent dwelling-place. This conclusion is rendered quite certain by the fact that the objects and occurrences of the so-called external world appear most vividly also in dreams while our eyes are closed to outside influences. You cannot but acknowledge that nature, as we know it, is altogether inherent in mind, and that it consequently receives its true interpretation in pure idealism.

Nat. You will never succeed in convincing unsophisti-

cated mankind, that no influence from outside man's own circumscribed individuality is here operative. If normal human beings open their eyes in complete darkness no external world becomes at all visible. Not the least change takes place in their own constitution and attitude between the opening of their eyes in darkness, and their opening them in illuminated surroundings. Yet what an all-important difference it makes to them! In the latter case there flashes into awareness the visible world with all its objects of more or less vital interest to us; in the former instance our vision remains empty of all content. It is very evident here, that this thoroughgoing difference is not brought about by any influence emanating from our own mind. The inevitable conclusion is then, that the influence which has wrought this revealing change must have reached us from outside, and that empty darkness can be only due to the exclusion of this external influence. Luminous space is our fundamental visual sensation incited by the influence of what are called etherial vibrations upon our open eyes, and the shaded and colored forms which appear therein are definite determinations of such luminous space corresponding to definite specifications of the inciting vibrations. Without reference to outside influences no sense can be made of the all-revealing conscious content.

In further elucidation of the insufficiency of pure idealism try yourself to believe that, for instance, no dead body is left behind when consciousness, mind, spirit, soul, life have ceased to animate it. Will it ever sincerely satisfy the sound and sober sense of any person to have speculatively demonstrated to him, that after death there remains extant no such thing as the dead body of his friend, save as it exists in his mind as his own percept; nay as it exists in the mind of any number of beholders as each one's own

percept, and therefore as ever so many bodies of the same friend?

Of course a consistent idealist will at once object, will have to object, that there exist in reality no other persons anywhere outside the mind that is actually aware of them as forming part of its own all-containing conscious content. And it is quite true that persons as mentally perceived have no other existence save in the conscious content in which they appear. This specious idealistic half-truth, besides leading to solipsistic nihilism, has seduced many a thinker to conclude that there exists in reality no individual mind, neither a mind exclusively belonging to you nor to any other human being, but solely one indivisible, eternal Mind or Spirit, in whose all-comprising Being everything perceived and conceived in reality exists.

Id. Well, and why not? Have not thinkers of highest repute reached this very conclusion? Is not this the essential teaching of panlogism, and indeed of all pantheistic creeds of idealistic cast? Have not many foremost philosophers, and also great poets, mystics and theologians, found intellectual and emotional satisfaction in just such a creed? Since Anaxagoras and the divine Plato attributed supreme reality to reason, have not most lofty-minded thinkers thought to recognize beyond all limitations of time and space pure reason as the norm of truth, and as essence of eternal being; while to them the sense-apparent world seemed a mere illusive play of phenomenal appearances?

Nat. Quite so, but only because these eminent thinkers and dreamers failed to realize the utter insubstantiality and evanescence of all mental modes, the fleeting phenomenality of our entire actual awareness, wherein everything of ideal or mental consistency has its transitory being. Rightly considered there is no such perduring substance or entity as consciousness or mind is supposed to be. We

are actually aware only of arising, dwindling and vanishing conscious phenomena, bearing a distinctly specific character and significant practical meaning. But we are nowise aware of such a collective enduring entity as self-rounded consciousness or mind would have to be as comprising and issuing matrix of them all. Our moment of actual awareness constitutes what we know as the present in radical contradistinction of what we know as the past and the future. The past has vanished for evermore; the future has not yet come to be. In present awareness is revealed all that belongs to ourselves, and all that belongs to the world at large. It needs but a moment's consideration to realize this momentous fact of conscious revelation. Our present moment of awareness, our actual conscious content, is therefore, as indeed generally admitted by philosophers, our only source of information. Notwithstanding it is evidently as transitory and lapsing as time itself, whose perpetual flux it fills with a medley of ever renewed mental phenomena. Or rather its own perpetual flux on a steadfast background of memorized experience and of physical regularities gives rise to our conception of time. The seeming endurance of some of these mental phenomena is altogether illusive. They are without exception fleeting and evanescent, and form only for the time being the appearances that make up the transitory conscious content, passing through awareness in a continuous stream, emerging into it and seeming to endure therein only by being uninterruptedly replaced by a new influx of more or less similar modes. In no two moments of time is the conscious content identically the same. No modicum of self-enduring consistency attaches to anything of conscious or mental consistency. All mental phenomena are as such but rainbowlike appearances. The seeming steadfastness of the world figured in visual perception rests in phenomenal repose on a foil of ceaseless change.

Id. The considerations you are bringing forward against pure idealism are only common sense apprehensions that are effectively dispelled by thought proving that the perceptual appearances which in random and fragmentary glimpses are projecting into awareness the semblance of an external world are but an illusive mirage distortedly reflected from the eternal plenary space of the intelligible world, where genuine reality is constituted by reason alone. Is not the conception of what we hold to be true reality the *re*cognition of an eternal normative realm of spiritual existence, where veritable being consists in a rationally all-inclusive idea, in an eternal *nunc stans* of reason's unified archetypal concepts? Is not our own intuition of universally valid truth, our ideal of justice, love, beauty, inspired by a transcendent forecast and longing for perfection, for reunion beyond all vicissitudes of this temporal existence with ever unchangeable all-sufficient Being?

Nat. Yes! that which constitutes genuine truth cannot be but out and out rational. The random, fragmentary appearances which arise within awareness have to be synthetically worked up into rational consistency, into harmonious agreement with previous experience, before they can afford any reliable information or inspiration. When and by what means does such an enduring synthetical unification take place? "How are synthetical propositions possible?" It is but a poor account that pure idealism can give of this momentous occurrence. Deprive its spiritual idea of sense-derived experience, or its perceptual phenomena of reference to extra-conscious existence, and you empty it of all objective reality, reduce it, in fact, to a senseless, meaningless nothing. This sweeping assertion cannot be refuted by ever so ingenious argumentation. It is all too positively evidenced by direct experience.

Kant after life-long profound contemplation declared emphatically in opposition to all modes of pure idealism,

that concepts remain empty of content if not supplied by outside influences with sense-material, supplied with the vivid appearances which arise in time and space as given raw-material of knowledge. Kant labored most assiduously to unify the seemingly disparate worlds of sense and intellect, the *mundus sensibilis* with the *mundus intelligibilis*. Influenced by Hume he made another most laborious attempt to accomplish this perennial task. He sought to restore the sensible world to its rightful share in the makeup of knowledge, a share of which it had been completely deprived by Leibnitz, whose philosophy was then dominant in Germany. But by admitting the existence of a causative intelligible world, where we human individuals were held to have our real being as "intelligible egos," and where a universal consciousness was believed to be the bearer and apperceiver of the synthetical unity of all that is empirically experienced; by admitting these transcendent intelligible potencies Kant became, contrary to his intention, the founder of pure intellectual or spiritual idealism. And by admitting a power of free moral causation as endowment of the intelligible ego he became also the founder of pure volitional idealism.

However, in order to prove irrefutably the essential part sense-imparted experience really plays in the constitution of knowledge, and the utter impotence of thought without having been first informed by it, we are not dependent on mere reasoning from psychological data. Positive demonstration that sense-derived experience furnishes the material which makes up the content of conceptual thought is unmistakably afforded by the blind, the deaf and preeminently so by the blind and deaf. It cannot be denied that the congenitally blind have no knowledge, no cognizance whatever of the world normally revealed in vision; the congenitally deaf no cognizance of that revealed in sound. All that fills our moment of awareness with the

rich content of visible and audible information regarding the means of satisfying life's needful requirements, and regarding its objects of delight and terror, all this sensorially accruing knowledge is wholly non-existent to beings devoid of sight and hearing. Not only this plain evidence of the dependence of concepts for their content upon sensorial experience, but further decisive proof of the indispensableness of sense-derived experience in the development and manifestation of intelligence in each separate human individual is afforded by language.

Deaf persons, linguistically untaught remain in consequence all through life in a state of imbecility. Being shut out from the world of sound, no linguistic vocal signs can convey to them the discriminative distinctions and apprehended significance of such experience as is not merely subservient to animal needs and desires. It is certain that without the knowledge and use of linguistic signs of some sort there can be no thinking, and consequently no intelligence of the conceptual kind. Thought and language are inseparably bound up with each other, are wholly interdependent. Here, then, is another fundamental fact of actual experience for philosophical contemplation to probe, in order to penetrate more deeply and truthfully into the secret of the relation of conception to perception, of that of mind to body, of the dependence of intelligence on a social medium. No human being becomes intelligent before having been first taught the linguistic vocal signs, or some equivalent for them, current in the social community to which he belongs. This is as much as to say, there exists no human being, no thinking and talking biped, no intelligent creature whatever, outside the social circle into which he is born, or in which he has been brought up. With such positive experience, with such irrefutable foundation to reason from, it is surely egregiously misleading and fanciful to assume any kind of intelligence or reason

that can exist outside a definite social community, and ignorant of linguistic signs socially inculcated. A human being becomes human as radically distinguished from other living creatures chiefly, nay almost exclusively, by the acquisition of linguistic signs, which invest him with the power of thinking. No thought, no intelligence without socially acquired speech. This obvious truth is daily taught by direct experience. And candidly attending to it, what venerable philosophical aircastles dissolve into nonentity!

Id. It is surely contrary to all reason to maintain that by learning some kind of linguistic signs socially agreed upon one develops from a state of mere unthinking, instinctive animality into an intelligent human being. Who can believe that intelligence or reason can possibly be engendered by so slight and casual a cause? If our mental nature failed to be rational in itself, to be innately endowed with intelligence before we get to learn linguistic signs, we should certainly remain all through life as thoughtless as other animals. A parrot does not become a thoughtful animal by learning to utter linguistic signs.

Nat. What you contend for is quite true. Without innate endowment of potential intelligence no actual intelligence could possibly be developed by learning linguistic signs. But, on the other hand, all potential endowment of intelligence remains sterile without being fertilized and actualized by language.

It has to be insisted upon that idealism furnishes but a superficial interpretation of such marvelous manifestations as the sudden vision of an external world on opening our eyes, or the development of actual intelligence by means of linguistic signs. Intelligence is nowise an *a priori* attribute belonging to mind, as a "thinking substance." On scientific investigation those marvelous manifestations are found to be achieved results of endless vital toil leading to progressive organization. In the light of biological

knowledge mental phenomena are final outcomes of this organizing process. They are supreme resultants of æons of vital travail, perceptively evinced in the phyletically organized structures underlying them.

Mental phenomena can rightly be called mental only when they appear as consciously present. When they are not present as conscious they have ceased to be mental, and are wrongly conceived to be still mentally subsisting in latency by puzzled idealists in search of something substantially enduring to build their systems with. It is obvious, on the other hand, that mental phenomena after having vanished out of conscious awareness are somehow reproduced from an extra-conscious matrix. The flow in time of arising and vanishing mental phenomena as consciously manifest must evidently issue from some permanent source. And as mental phenomena carry with them former experience now memorized, it follows that such former experience must have been potentially preserved in some retaining mould, much as the voice is latently retained in a phonograph. Only here the organic mould is a vitally active retainer that assimilates newly acquired experience with such as had been previously revealed, deepening and amplifying former information. What is so glibly called "memory," wherein is consciously resuscitated in momentary awareness the latently retained experience of our lifetime must necessarily dwell in some perduring extra-conscious matrix potentially harboring it. Such a matrix has consequently to possess the attributes universally ascribed to what is philosophically called "substance." It has namely to remain itself identically intact and functionally efficient, while nevertheless emitting the sundry manifestations that appear in conscious awareness. This substance being the inexhaustible source of conscious phenomena has to combine in itself the logically contradictory and yet logically desiderated attributes of

unchangeableness and change; has, in fact, to consist of an underlying entity which remains itself identically unchanged, being nevertheless the source of the flow of endless changing modes. It cannot be denied that it is logically incomprehensible how anything can be the source of the flow of manifold occurrences without changing and spending itself in so doing.

The conception of such an identically abiding substance which is nevertheless the source of the changeful manifold, lies at the root of all metaphysics. All attempts at interpreting nature have assumed as foundation to reason from some such identically enduring substance. Not to mention the many ingenious devices resorted to by ancient sages of all civilized lands and times in order plausibly to evolve the many from the one, modern philosophy to the present day has been mainly concerned with this logically and dialectically insoluble problem. In their perplexity at not being able to discover the desiderated substance in nature, thinkers were led to assume some kind of fictitious entity to do service for it. The outright dogmatism of such an arbitrary procedure becomes evident in Kant's *a priori* definition of substance, "*In allem Wechsel der Erscheinungen beharret die Substanz,*" Amid all change of what appears the substance endures. And he significantly added: "Its quantity in nature neither diminishes nor augments." This addition was evidently formulated in order to state *a priori* that the desiderated substance must not itself be spent in giving rise to what successively appears as the content of time and space. Kant tells us plainly what a genuine substance ought to combine in itself; namely: "*die entgegengesetzten Bestimmungen,*" the contradictory determinations of preserved identity amid change.

It may well be asked if any of the assumed underlying substances of philosophers really combine in themselves logically contradictory determinations. They generally as-

sume as underlying substance some identically abiding First Cause, *causa sui,* as Spinoza expresses this cutting of the Gordian knot of philosophy. The assumption is, however, something unthinkable, for under "causation" is rightly understood a sequence of effected events without conceivable beginning or end. Here our human understanding stands baffled by losing itself into infinity both ways. Such a fictitiously posited First Cause is then conceived, either as an omnipotent personality, or as eternal intelligence, reason, absolute idea or substance, or as the Absolute outright, as the mystic Nothing from which everything proceeds, as psychical *actus purus, Urgrund,* indestructible matter eternally driven into changeful forms by indestructible motion, and lately also as all-efficient protean energy. These are the principal first causes that have been hypothetically substantialized into permanency to serve in turn as identically enduring matrix, whence the experienced phenomena may be made plausibly to issue into manifest existence.

After all these vain attempts to discover the genuine substance, which in reality combines in itself the logically contradictory attributes of unchangeableness and change, philosophers will have to apply to biology for solution of this eminently momentous puzzle. Then only will they receive the real experiential groundwork, which will enable them effectively and validly to reason regarding the evolution of the problem of the many from the one, of the changeful manifold from an identically abiding matrix, of the succession of mental phenomena from a vitally active source. It has to be emphatically declared that solely in the *perceptible* living organism,—not in its mentally *perceptual* representation—is to be found in our world the veritable substance that remains itself identical, while emitting all the changeful phenomena of the conscious content.

Id. So after all you side with the materialists who be-

lieve that it is our body that thinks, that certain molecular agitations of brain-substance give rise to mental phenomena, and are thus their efficient cause. From what you previously admitted it seemed that you accepted Berkeley's idealism, in so far at least as it proved the non-existence of such an entity as a material body. Surely what is perceived as our body or organism consists in verity altogether of a group of sensations, principally tactual and visual.

Nat. Quite so, but how does it happen that the body or organism of this dog, for instance, forms at the same time part of your conscious content as well as of mine? You will hardly deny what is universally acknowledged, namely that one and the same thing or individuated object cannot be in two places at the same time. Moreover, it is certain that I cannot touch or see the perceptual dog forming part of your conscious content, nor can you that forming part of my conscious content. Evidently then your percept of the dog or mine cannot possibly be operative in causing either of us to perceive the real dog, which neither you nor I can well deny that we distinctly perceive. Nor could each of any number of beholders deny that he likewise perceives pictured in his conscious content the percept of the same dog. Should you, however, nevertheless deny the existence of such numerous percepts of the same dog in numerous percipients, and that any real dog exists save the one appearing in your own conscious content, it would consistently force you also to deny my existence outside your conscious content, a preposterous and untenable position, although necessarily held by pure idealism. For without touching, seeing, and hearing me you would be wholly unaware of my existence, and could therefore not perceive me as forming part of your conscious content. It is a positive fact that the conscious phenomena arising in the conscious content of any individual cannot be perceived by any other individual; while, on the contrary many other

individuals can simultaneously perceive the same real body in the same objective place. This proves that the nature of the real body differs in consistency and actuating power entirely from anything mental. The irresistible conclusion here is, that the body, thus perceptible to many beholders, forms part of an extra-conscious, non-mental world which possesses the power to compel its perceptual representation to arise in the conscious content of whomever is in a position to behold it. That the real extra-conscious world is sense-revealed, and not a mere mental product is unmistakably demonstrated, as previously shown, by the congenitally blind and deaf.

The apparently mysterious fact, that the extra-conscious, but perceptible world is found to correspond to its perceptual representation, constitutes another problem that no conceptual reasoning can in the least degree elucidate, while biology is in a position to furnish at least a proximately satisfactory and scientifically valid explanation of it.

Id. It is indeed obvious that mental phenomena are not sensorially perceptible, that one cannot touch with hands or see with eyes any feeling, sensation, percept, thought, or conscious emotion. Transcendental idealism will unhesitatingly agree to this, as it can consistently admit only one single, all-comprising mental content as sole reality. It has to be confessed, however, that it seems to have been made good in this discussion, that externally incited, sense-derived experience, memorized and symbolically synthetized, goes to make up the content of concepts. This experientially demonstrated fact, I am afraid cannot be argued away. If so, it seals with thinkers, who candidly ponder it, the fate of pure idealism, as pretending to be a sufficient interpretation of nature.

But admitting the bare existence of a real extra-conscious world, we evidently do not know its real nature, but only its perceptual representation in the conscious con-

tent. And therewith the real nature of what underlies our sensorial susceptibilities remains unknown. We only become aware of their organized embodiment perceptually revealed as our organs of sense. The real nature of the extra-conscious world, whose intrinsic powers compel definite percepts to arise in our conscious content, remains as enigmatic as that of Kant's things-in-themselves, or Berkeley's divine *fiat*.

Nat. It must, indeed, be quite incomprehensible to thinkers unacquainted with biological results, how the perceptual world arising in conscious awareness has come to symbolically represent, and significantly to correspond to an incommensurable extra-conscious world vicariously revealed mainly through an etherial influence affecting our vision. Here a plain remark may serve to disentangle incongruent problems, the mixing up of which has sorely confused philosophers of all times. The problem of the inner and vital conditions that underlie the arising of mental phenomena is of an entirely different order from the problem of the real nature of the extra-conscious, sense-compelling world, and its conative and cognitive significance to our individual needs and desires; and this again is of a different order from the weighty problem of memorizing, by which process inner and outer impressions, carrying with them unconscious and conscious experience vitally and emotionally needful to our existence, become organically blended and latently retained.

As our real perceptible organism forms itself part of the great extra-conscious, power-endowed world, and also underlies functionally our vital and purposive activities, and is besides the bearer of the significantly memorized and synthetically unified mental phenomena, the three otherwise separate incongruent conditions and influences combine here to give rise to the all-revealing conscious content.

Biological research is a laborious pursuit requiring

close observation and persevering application; moreover a single-minded, unbiased desire to correctly interpret compulsory sense-phenomena directly given or experimentally made to appear. In contrast with such scrupulously ascertained truth regarding natural facts and occurrences to reason from, the general method of philosophizing has essentially consisted in reasoning from randomly gathered and intuitively generalized experience, or even from mere imaginary conceptions arbitrarily postulated. The many philosophical failures to rightly account for natural occurrences are principally due to the ascribing of substantiality and efficiency to mental phenomena, which are, in verity, all forceless and evanescent. Nothing mental, it has again to be insisted upon, possesses as such any modicum of substantiality, or causative efficiency. And here we have above all to recognize that what we call our intelligence, pre-eminently a manifestation of mentality, is powerless to add the least efficacy or to impart any kind of new property to nature and its perceptible constituents. It can, however, designedly devise for them new opportunities, by which they are placed through the volitional activity of our extra-conscious being in positions to display properties and powers hitherto latent and potential only. Intelligence can furthermore inventively render natural properties and efficiencies subservient to our lower and higher needs and desires.

Having in mind the three essential problems, whose correct solution alone can furnish the true foundation for a valid interpretation of nature, let us test in this respect the thought of recognized leaders of the two different idealistic ways of interpreting it.

Kant, perhaps the most circumspect and painstaking of modern thinkers, as regards the first problem completely ignored the part vital organization plays in the synthesis of sensorial, and in fact of all experience. He held all syn-

thesis to be the function of what he called *a priori* categories of the understanding. These categories are, however, in verity, mere abstract generalizations of experienced connections between succeeding and coexisting natural phenomena. Being mere concepts, they are themselves entirely impotent, and have in Kant's system to borrow their alleged functional efficiency from an imagined supernatural, power-endowed realm of noumenal existents, of which our own real being under the name of "intelligible ego" is believed to form part, and to exert moreover a power of free moral causation, enabling it to initiate from its timeless and spaceless dwelling-place effective changes in our time-and-space world.

With regard to the second problem, by not recognizing the manner by which existents of the extra-conscious world —called by Kant "things-in-themselves"—are and have become empowered to cause definite sensorial appearances to arise in the conscious content,—in his language to fill time and space, our empty forms of intuitive receptivity, with unsynthetized sensorial raw material—he left this all-important occurrence wholly unexplained, taking no further notice of this unremitting effective connection between the extra-conscious world and the world of conscious awareness. Therewith he entirely shut himself up in the magic circle of mere subjective consciousness, a position which consistently thought out leads inevasibly to pure solipsistic idealism. Or admitting, inconsistently however, a plurality of other subjective consciousnesses, it leads to Leibnitzean monadology. From this hopeless and helpless imprisonment in his own solitary phantom-peopled self, Kant sought to extricate himself by evoking assistance from his imagined intelligible world, calling upon it to impart objectifying efficiency to his otherwise impotent subjective categories.

The third problem Kant circumvented by leaving un-

explained how newly acquired experience really happens to become latently preserved and memorized, potentially ready on occasion to issue as consciously resuscitated into actual awareness. He recognized that the perpetual flux of time carries away with it its entire freight of conscious phenomena. This being so, this transitoriness and evanescence can obviously not be arrested and permanently fixed, nor its content registered, by any purely mental process. Consequently without some non-mental preserving matrix there could exist for us no past and no future. The whole world we are now consciously aware of would have never come into existence. All accruing experience, if such could take place, would instantly vanish into complete oblivion. Of such paramount importance is the biological fact of memorizing.

Hume, and with him all nominalistic or subjective idealists and associationists make the interpretation of nature an easy task for themselves. They simply ignore the existence of an extra-conscious, power-endowed world, and invent, to begin with, the building material wherewith to erect their philosophical air-castles, working with nothing but transitory feelings of more than doubtful individual existence. These they arbitrarily substantialize into perduring existence, and set about mentally to construct with them what they declare to be the real world. The real world they in all seriousness believe to have been put together by combination or rather aggregation of the flimsy, fleeting mental atoms called by them "sensations" or "impressions." Such vivid sensations or impressions are thus held to arise in actual individual awareness as given in an entirely mysterious way. Thereupon they are believed to be retained as memorized in extra-conscious latency eventually to be summoned into consciousness as faintly reproduced "ideas" that have become by habitual experience associated in definite ways with their vivid prototypes.

To postulate "memory" unexplained as an abiding, extra-conscious matrix, which receives, latently preserves, and on occasion emits into conscious awareness all accrued and all accruing experience is an eminently unscientific procedure which amounts to virtually begging the entire question of mind and its knowledge. The problem of mind, and therewith of memory, can be solved only biologically by recognizing that the world of consciousness is an outcome of vital activity emanating from the perceptible, phyletically elaborated entity, revealed in perceptual awareness as the living organism.

Id. After all your lengthy exposition it remains still unclear to me how from data of the conscious content, arising subjectively in an individuated being, and admitted to be the only directly given source of information, how from such exclusively subjective mental phenomena, it can be legitimately inferred that an external world really exists independent of that which perceptually appears as such, and that, moreover, our organism and its environment, with all their alleged efficient interactions, consciously forming part of one and the same conscious content, can in an extra-conscious world exist as separate entities. Mind, according to this naturalistic view would then be merely a gradually developed functional outcome of toilsomely elaborated structural organization, and not as idealism, and indeed most philosophers contend, an original, power-endowed, all-comprising entity, having its true home in a purely intelligible sphere.

Nat. I thought you had become convinced of the independent existence of an extra-conscious, non-mental world, and that you consequently agreed that idealism is a mistaken position. Possibly your revived doubts as to the correctness of naturalistic views are caused by the fact, that in my defense of them I have mostly presupposed, may be without sufficient demonstration, the existence in

non-mental nature of a plurality of human beings, while it is of the essence of pure idealism not to admit such a plurality. In consequence of it nominalistic idealism, as already stated, leads inevasibly to solipsistic phenomenalism; and transcendental idealism has to postulate as sole reality a universal absolute Intelligence or Reason.

The all important contention between the belief of idealism in all-efficient, all-comprising mind, and the belief of naturalism in the independent existence of a non-mental world of power-endowed interacting existents hinges—paradoxically enough—on the demonstration of the real bodily existence of other human beings outside the conscious content in which they perceptually appear. Philosophically speaking such demonstration draws with it the proof of the existence of an "objective," extra-mental world. It is undeniable that if other human beings consisted really altogether of such mind-stuff as constitutes the conscious content, their appearance in perceptual awareness would be wholly unaccountable. And besides, the vision of perceptual human beings and their movements, when they appear, amounts in any case only to a pantomimic play of insentient phantoms, much as that of human phantoms and their actions projected intangibly into mid-air by means of reflecting mirrors. The significance of the actions of such phantasmal beings, unwilled, unknown and unfelt by themselves, has to be interpreted by the memorized experience of a feeling and understanding spectator. What, then, is the real nature of such a spectator, who cannot be himself a mere perceptual phantom? And where do these phantasmal scenes really take place? Are they perchance mere reflections in individual awareness of what really exists and takes place in a universal consciousness? Such was the reasoned conclusion arrived at by Malebranche, by Kant in early days, as witnessed in the following sentence: *"nempe nos omnia intueri in Deo,"*

and virtually also the conclusion of Berkeley and other thinkers. Transfer speculatively all substantiality and actuating power in nature to a purely intelligible sphere, and this is the necessary logical outcome of the assumption.

But if no human beings really existed save those displaying themselves in universal consciousness, mind or spirit, whence the momentous, multifold significance of all that visually appears to the bearer of the revealing consciousness, who can hardly be denied to be an individual being?

If it can be shown that the perception of other human beings is sense-compelled by outside non-mental influences, then pure idealism has lost its vantage-ground. For its chief contention is to deny all non-mental existence. If a solitary individual percipient neither sees, nor touches, nor hears other human beings, they remain wholly unrevealed to him. He becomes aware of their existence and presence solely by means of sense-compelled percepts. Consequently, without such directly compelled sensorial experience perceptual bodies of other human beings would not arise in his conscious content. When they nevertheless appear independent of any sense-compulsion, as in dreams and hallucinations, they are evidently the outcome of his memorized fund of previous sensorial experience. As no kind of mental phenomena, and certainly no percept, can be seen by means of our visual organs or touched with our tactual organs, or heard with our auditory organs; as they have in fact not the least power to affect our sensorial susceptibilities, we could, as has been repeatedly said, never become aware of other human beings, in case they really consisted of nothing but mind-stuff. We become, however, most distinctly aware of the body of other human beings by means of sense-compulsion. Consequently this their body must necessarily consist of something differing totally

from mind-stuff, which has no power whatever to affect our sensorial susceptibilities. The presence and meaning of the imperceptible mental phenomena arising in the conscious content of sense-revealed human beings we outside observers get, on the other hand, to know only indirectly by means of symbolical physical signs emanating from them, and being interpreted by our own conatural mental experience.

When we consider by what indirect means the real extra-conscious body or organism becomes perceptually revealed: by touch through feelings of resistance, by sight through the vicarious agency of what are called ethereal vibrations, by hearing through the influence of "waves of air," by smell through wafted influences, by taste through chemical affinities; when we consider these indirect sensorial modes by which the existence and characteristics of the extra-conscious world are made to arise in the wholly incommensurable medium of our conscious content, we can form some remote idea how profoundly the sensorially revealed, power-endowed bodily organism, belonging to the extra-conscious world, must differ in its real nature from its forceless, evanescent perceptual representation. This real nature evinces its intrinsic powers in the effects it produces in our world of conscious awareness. The extra-conscious entity perceptually revealed as the living organism is in all reality the substantial being that performs all vital functions, psychical as well as physical.

The real existence of the bodies of other human beings, independent of their perceptual appearance, having, I think, been sufficiently demonstrated, weighty naturalistic conclusions follow therefrom. It is evident, for instance, that the perceptual awareness of my organism and its functions by an outside observer, being a mental phenomenon appearing exclusively in himself, cannot possibly have the least effective influence on what takes place exclusively

in myself. Hence the hypothesis of psychophysical parallelism. The physical aspect is the aspect of the outside observer, the aspect of the physiologist. The corresponding psychical occurrence—imperceptible to the outside observer—takes place in the observed subject. No wonder, then, that the two entirely different experiences, though both mental, respectively occurring in two different beings, run their parallel course without in the least affecting each other. The physiologist perceives as functions of the perceptual organism, which appears in his conscious content, perceptual motions. These he has hitherto interpreted mechanically by wrongly attributing to them forcible actuation, falsely taking motion to be a force-endowed entity, while it is a mere forceless perceptual sign of real activity astir in the real extra-conscious, power-endowed world of creative becoming. And so are all perceived motions in nature mere perceptual signs. Essentially the same sense-compelled percepts, revealing the presence, characteristics, and activities of the real extra-conscious world, make their appearance simultaneously in ever so many beholders, enforcing thus our belief and confidence in their objective significance. The conscious content of the individual, on the other hand, reveals to him the world as it has become synthetically memorized in his own being, and is as such wholly imperceptible to the outsider. In the unitary conscious content of the individual the structurally organized and memorized effects of the two different modes of awareness, the outer and the inner, appear significantly blended as "subject-object," as subjectively assimilated experience of the perceptible, extra-conscious world and the individual's own conscious relation to it.

Id. It is true that if other human beings consisted bodily—as pure idealism has to maintain—of the percepts which appear in the conscious content of the percipient, there would be consciously extant only the self-knowledge

of the one single monadic or solipsistic percipient, in whose conscious content all other human beings, together with the entire so-called external world, would then miraculously arise as his own perceptual phantom. To posit speculatively a multitude of such monadic percipients as Leibnitz and others have done, in order, I suppose, to hide the monstrosity of denying the existence of other human beings and things is logically absurd. No single monad, not even the central monad of the illustrious Leibnitz, could possibly become aware of the the existence of other monads, unless miraculously informed. By positively demonstrating the extra-conscious, bodily existence of other human beings, revealed by means of sense-compelled percepts, and by recognizing the imperceptibility and forceless phenomenality of such percepts, and indeed of all mental experience, pure idealism would seem to be effectively refuted, at least as regards the interpretation of the individual conscious content, which it must be confessed is the only one we directly know. But conceding all this for the present, it seems you have not clearly shown that an extra-conscious organism alleged to correspond to the one perceptually revealed, has to be legitimately recognized as the acting, feeling and thinking individual. And by reducing mind to a mere transitory forceless emanation, inferred to issue from an extra-conscious living organism as its functional outcome, you fail, I think, to recognize the supremely important and exalted part mind actually plays in our world.

Nat. The perceptually revealed structure of the organism, and its functions as interpreted in terms of motion, are found, as has been epistemologically shown, to be mere transitory symbolical representations of the real extra-conscious organism and its vital activities. A genuine force-endowed substantial entity is necessarily desiderated as permanent matrix of the fleeting conscious content. This has been recognized by foremost idealistic philosophers.

Leibnitz asserts that "a correct view of substance is the key to philosophy." Kant, with his usual penetrating insight, expresses this truth in the following terms: "*Substantiality is the supreme and first principle of nature, which alone secures unity of experience. For without something permanently abiding amid the flux of temporal changes there could be no synthetical connection and apprehension of natural phenomena.*"

The search after the entity which combines in itself the logically contradictory characteristics of this "supreme and first principle of nature," namely permanency and a flux of "temporal changes," was at all times considered the principal task of philosophy. Well, then, just such an entity—the only one in our world—as remains identical, while emanating all through life the changeful and fleeting mental content; an entity that maintains intact its own integrity and efficiency, while emitting in ever renewed sequence the flowing mental phenomena; such a substance as is necessarily assumed by philosophy, is experientially found to be actually given in the living substance, of which all organisms are composed.

What must seem a miracle to pure idealism, and what is logically contradictory to conceptual thinking—namely identity and change combined in one and the same entity—is brought about demonstrably by the natural work of perceptible nature wrought in the living substance. The seeming miracle consists in its structural and functional reintegration to essential identity and efficiency on having suffered the functional disintegration and waste which necessarily accompanies all vital activity. Physically speaking, what is called the life of organic beings is due to this functional reintegration from within repairing functional disintegration induced from without. Such see-saw play of disintegration and reintegration in interaction with the medium is the process which underlies all modes of vital

activity. Hunger and nutrition, fatigue and sleep are subservient to it.

Without such maintenance of identity amid constant change the living substance would irreparably consume itself, and in no two moments could the content of conscious awareness remain identical. There could be no abiding representative view of the perceptually appearing external world, and no sense of personal identity. Past experience could not become structurally organized and memorized so as to appear on future occasions resuscitated in present awareness as remembered. Here we find the valid natural solution of momentous riddles, that have baffled the ingenuity of conceptual thinkers, and to which biology alone has the key.

Memory of acquired experience very evidently depends on modification of what perceptually appears as organic structure. It is the outcome of reiterated function modifying underlying structure, and such specific modification being identically retained so as to issue on incitement into actual awareness as resuscitated past experience. Both physical and psychical education are wholly based on the modifying of structural organization in definite directions. The aim of education is to render new functional acquisitions secondarily automatic, which means to render them capable of being performed without conscious assistance as reaction upon definite actual or remembered inciting influences. The entire organization of the extoderm, sensory, neural, and muscular, is in fact the perceptible result of such vital interaction of the living substance with its environment. Hence reflex-action; instinctive performances, such as are most strikingly displayed by insects; our own confirmed habits; and educationally inculcated abilities. Structurally retained, latently memorized experience was attributed to organic structure by Ewald Hering* as early

**On Memory,* by Ewald Hering. Chicago: The Open Court Pub. Co.

as 1870. This was a great step towards a monistic interpretation of the relation of mind and body. But believing the process to occur in the perceptually appearing structure itself, wrongly held to be of material consistency, valid epistemological objections prevented a more general recognition of this profound insight into the true significance of structural organization. It may be safely asserted of all organization of the living substance that it perceptibly represents memorized experience of vital interaction with its environment, by means of which it has been creatively elaborated. Specific organization of the living substance wrought in the sphere of non-mental existence is clearly the work of creative activity operating in depths of being beyond the reach of what we call consciousness. Mind is a final result of such creative activity. After endless phyletic elaboration a microscopic germ, under favorable conditions, develops in unconscious darkness into a faithful reproduction of the parent organism. It issues then into the open world innately provided with the specific structures that underlie its vital functions, physical and psychical. What stronger proof can be needed to render certain to unbiased contemplation that mind is an outcome of vital organization.

The fact that vital activity is instrumental in elaborating organic structure is most obviously demonstrated in the gradual mastering by practice of new feats of physical and psychical skill. The elaboration of the organic structure forms part of the inscrutable creative process to which all elaboration of the multitudinous formations of the universe is due. It is brought about by means of specific modes of combination and interaction among existents that help to constitute the power - endowed, extra - conscious world. The strict dependence of physical and psychical function on the specific vital organization of the perceptible living substance is being more and more precisely ascer-

tained by comparative anatomy and physiology, aided by psycho-physical investigation. Most instructive in this connection is the anatomical, physiological, and especially the pathological study of the neural structures that underlie speech and its manifold defects. Upon the normal organization and function of these structures the rationality of us thinking human beings absolutely depends.

Now, finally, with regard to the "all-important and exalted" part mind is playing in our human world, I think it is recognized rather more profoundly from the naturalistic standpoint than from the idealistic point of view. Naturalism and idealism acknowledge in common that the conscious content is our sole medium of world-revelation. Consistent idealism maintains that this world of consciousness is the only real world. Its revelation means consequently to the idealist its own intrinsic self-significance, without reference to anything outside. Naturalism, on the other hand, maintains that it is a revelation of the presence and practically significant characteristics of an extra-conscious, power-endowed world of interacting real existents, of which our own real being forms part. To naturalism multifold powers of nature conspire to elaborate on our planet all-revealing mind, as the crowning outcome.

The revelation of the extra-conscious world in present awareness is for us human beings of paramount conative as well as cognitive significance. Our entire organism being the result of organically memorized phyletic interaction with the environment, its present conscious memory wells up from unfathomable depths of structurally organized experience. Such experience evinces itself consciously first as organic needs with impulsions to instinctive activities structurally organized to satisfy them in relation to the special environment, to which the organism has become phyletically adapted. In higher structural regions it manifests itself in harmonized experience that imparts order,

unity and beauty to the revelation of the conscious content; further in what Plato called *anamnesis,* and in transcendent intuitions, emotions and aspirations. Hence reverential awe in presence of the inscrutable might that creatively labors with birth-throes of progressive attainments; hence our superindividual worth as bearers of the achieved results of endless vital travail; hence the emotive thrills of soul-stirring music, the faculty of artistic creation, and of all manner of exalted performances by those among us who deserve the name of genius; hence the inspiring swell of symphonious cosmic and social consciousness; and hence the sacred import of family ties, and the ever widening range of altruistic sentiments.

The structures underlying conscious manifestation—our conative propensities included—are so organized as to focus in our present moment of awareness a whole world of gradually accumulated and systematically organized experience. This is accomplished by the issuing in practically simultaneous awareness of a more or less rationalized system of representative mental signs. By recognizing their inner and outer significance there is offered to the percipient for free choice of volitional activity a manifoldness of possible directions, and therefore an opening for overruling mere instinctive impulsions. The deliberate choice among these different possibilities presented to purposive actuation determines our more or less rational and ethical conduct in life.

By means of socially gathered experience, consciously concentrated in present awareness, and the volitional choice of a rational and ethical course of action in relation to our physical and social surroundings, progressive organic elaboration towards higher fulfilment becomes inwrought into the structures that underlie the conscious content. The creative process is the same as that by which has been developed the hitherto attained humanization of our orig-

inal animal nature, while concomitantly it has resulted in enriching and enhancing the source, whence our world-revelation issues now into present awareness magically outspread before our glorified vision, the familiar playground of ineffable joys and griefs deeply astir in the warp and woof of our emotional nature. Living structure, as perceptually revealed in the exquisitely minute and significant organization of the human brain, is the veritable embodiment of the perennial, phyletically developed, soul-life, of which we now here are the transitory bearers and beneficiaries.

Id. Granting that an extra-conscious world, peopled by extraconscious human beings really exists, as is the conviction of unsophisticated persons, your epistemological and biological interpretation of nature seems plausible. Philosophers, however, unused to give due weight to biological facts, and who have come firmly to believe in mind, intelligence or reason as the veritable power-endowed cosmical entity, will be impressed by it as all too mundane, and its account of laborious world-creation, with mind as the crowning outcome, all too irksomely accomplished to be brought into harmony with divine might, and its free exercise.

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THE PHILOSOPHY OF PERSONAL EQUATION.

> "Of whatever temperament a professional philosopher is, he tries, when philosophizing, to sink the fact of his temperament. Temperament is no conventionally recognized reason, so he urges impersonal reasons only for his conclusions. Yet his temperament really gives him a stronger bias than any of his more strictly objective premises. It loads the evidence for him one way or the other, making for a more sentimental or a more hard-hearted view of the universe, just as this fact or that principle would. He trusts his temperament. Wanting a universe that suits it, he believes in any representation of the universe that does suit it."—*Wm. James.*

PRAGMATISM may be characterized as a philosophy which insists upon the significance of the personal equation in thinking. There is no doubt that the theory works well in explaining how certain thinkers arrive at definite results. It fails only—but in this it fails most significantly—in establishing a true philosophy; yea we might say that pragmatism (if it is to be taken seriously) actually denies the possibility of philosophy as an objective science. It deems the personal equation to be the essential feature of all philosophies, whereby philosophy changes to a mere expression of temperament, of mood, subjective disposition or the like; in this case philosophy ought to be classed with *belles lettres* and be judged as poetry. This is the opinion expressed in the editorial criticism of Pragmatism in *The Monist* (Vol. XVIII, pp.321 ff.), and we are glad to notice that Prof. Edwin Tausch at the end of his article on Professor James expresses a similar verdict.

It is true enough that the personal equation is an im-

portant element in all mental activity; even the most mechanical transactions of observers exhibit a certain regularity of definite fluctuations due to the makeup of the observer's mental organism. When the astronomer makes his observations he discovers that they are vitiated by certain irregularities which in the same person keep within certain boundaries. They are due to the limit of exactness within which the observer's nervous system, the eye, the ear and the hand perform their functions. The personal equation is a factor which has to be taken into consideration. During the development of science it has been more and more reduced, but it appears that it can never be absolutely obliterated, because organisms as well as machines are never absolutely perfect but work with accuracy only according to the nicety of their adjustment.

The factor of the personal equation is less important where the facts are plain and where the observations consist (as, e. g., in astronomy) of mere measuring or counting, but it grows with the complication of the problem.

In the domain of philosophy, religion, ethics, sociology, political economy, and generally in the interpretation of all spiritual aspirations of man, more personal interests are at stake than in astronomy; and since a general belief in a certain doctrine is an important factor in actual life, man's judgment is much more easily influenced by his desires than in natural sciences. Hence a widened scope of the personal equation. In political economy the personal equation asserts itself so vigorously that it tries to overrule the facts and is usually in readiness to twist them to suit its own convenience. We know but too well that business interests, not scientific arguments, are the decisive factors that shape man's views concerning the tariff, and conditions are similar when our favorite ideals are under discussion, our notions of God, the soul, of immortality and ethics.

Men who allow their views in politics to be shaped by private interests lack breadth of mind and fairness towards others, while sentimentalists who are incapable of logical reasoning whenever their feelings are engaged are pathological. It is true that very few people can boast of a perfect mental health, but we need not for that reason surrender our aspiration for objectivity in thought and leave the decision as to what should be recognized as truth to the prejudices of subjective preferences.

The mistake of the pragmatist consists in regarding the part which the personal equation plays as the essential feature of cognition. What is a mere shortcoming of thought is raised to the dignity of the main principle. In the pre-scientific age almost all practical problems of life were settled more in accord with the dictates of the will than of the intellect. Nevertheless the intellect was not inactive. The intellect has gradually asserted itself more and more and from the domain of the will it has wrested the formulation of one doctrine after another. Sometimes it upset old cherished errors, and sometimes it modified the traditional view by adapting it to new conditions.

During the present age the influence of science on religion has grown more and more and the will to believe has become less and less the ultimate determinant of religious convictions. We are fully convinced that there are not two domains of truth, one the noetic, the other the teleological or spiritual. The so-called spiritual sciences, psychology, the history of religion, philosophy, ethics, are based on a condition of objective facts just as much as is the knowledge of the purely mechanical processes of nature. There is only this difference, that men of a sentimental temperament are more easily influenced in their judgments in the so-called spiritual domain of the sciences, philosophy, psychology, ethics, etc., while the scope for difference in the domain of the intellectual truth, logic,

physics, chemistry, astronomy, etc., is scarcely any longer possible.

To the pre-scientific man conviction is truth, and the intensity of his conviction is naively accepted as the measure of the reliability of truth. The pragmatist is really naive enough to continue, or rather to fall back upon this pre-scientific stage of thought. So he looks upon science as an assumption and has no use for the work of those philosophers who have laid a foundation for philosophy as an objective science. In this sense pragmatists declare Kant to be antiquated, *ein überwundener Standpunkt.*

Think what would become of the reliability of astronomy if we had to look upon the theories of Copernicus, Kepler and Newton as the products of personal equations simply because an element of personal equation is to be taken into account in the astronomical calculations.

Pragmatism has taken a strong hold upon the present generation, but it remains to be hoped that this is more due to the attractive personality of Professor James than to any intrinsic power in its leading ideas. If pragmatism were right the only scientific treatment of a philosophy would be the one which Professor Tausch administers to Professor James. He abstains from critically investigating the latter's views but analyzes his doctrines and explains them in terms of genetic psychology. It looks more like a physician's diagnosis than a philosophical inquiry, the more so when we notice that even in his methods Professor Tausch is inclined to imitate Dr. Morton Prince when he deals with disintegrated personalities.

I agree with Professor James in the recognition of the personal element that enters into the makeup of our philosophies, but while I propose to eliminate it and build upon the assured conclusions of our thought a philosophy of objective significance, he, being a man of strong sentiment, is so overwhelmed by the paramount part which the per-

sonal equation plays that he proclaims a doctrine called pragmatism which however would be more correctly described as a philosophy of the personal equation.

It is true that in philosophy, and in still higher degree in religion, it is very difficult for any man to discriminate between objectively assured arguments and his own personal equation, nevertheless it is not impossible to do so, and we take the progress of science, especially the obvious influence of science upon religion, as an evidence of our statement. We grant further that those philosophers in whom the personal equation is greatest, are most emphatic in the defence of their very errors, for when men of intense convictions are unable to prove their belief, they make up for the lack of logic by a display of the vigor of their faith. This is but natural and Professor James goes too far when he accuses philosophers of dishonesty declaring that they pass over in silence the most important arguments of their views. It is merely the character of a pre-scientific state of culture.

When I consider my own case, I must grant that the power of sentiment should not be underrated. Having freqently been obliged to let very intense convictions based upon inherited and early acquired habits be overruled by a calm consideration of the truth, I know very well that the personal equation exists, but I know also that it can be reduced to considerably lower terms, and I deem it the duty of every thinker to eliminate as much as possible in his search for truth the vitiating factor of his personal preferences.

But is not perhaps the entire fabric of all philosophies made up of strands that can be resolved into the fibers of our personal equation? The thoughts of many people are indeed so interlaced with their sentimental natures that if we consider their cases individually it would seem hopeless to let them establish a conception of the universe that would

possess any objective reliability. Nevertheless there are scientific minds who can formulate statements with objective exactness. The multitudes of people are unscientific, but science is not for that reason impossible.

Science is not only possible, science is a fact. And if it be granted that science is a fact, we can make bold to say that scientific method must be reliable. Here is the basis of the philosophy of science.

The philosophy of science is first the science of science, or methodology; then the synthesis of all the sciences in their unison, or ontology, including their systematized result, or a scientific world-conception; and thirdly the application of this world-conception to practical life; we may call it pragmatology which includes ethics, sociology, the crafts, inventions, art, etc. This domain of philosophy is as solid ground as any field of the natural sciences and the personal equation of the philosopher, far from being the dominant factor, is here as in astronomical calculations only a source of error.

A philosopher's personal equation lies mostly in his sentiments and it would seem that a rigorously scientific thought would leave no room for sentiment, but such is not, or at any rate need not be, the case. Science does not antagonize sentiment; it would only protest that sentiment should perform the function of thought. Let the mind think and the heart feel, but when the heart governs the head, the mentality of man is apt to lose its strength.

I grant most emphatically that the noetic function of man's soul is not the only feature that needs cultivation; the domain of sentiment and will with all that they imply, enthusiasm, sympathy, emotional yearnings, devotion, religion, the love of art, music, etc., have their due place in our lives and should not be neglected. But the intellect should after all remain the supreme court of all final decisions. The intellect should not be degraded into an *an-*

cilla voluntatis, a handmaid of either the will or sentiment, but should be as independent as is the judiciary in a well-governed state.

Sentiment, religion and artistic tastes are indispensable attainments, but even these need the guiding hand of intellectual comprehension. The intellect is the organ of reason, of logic, of inquiry, of grasping the truth, of comprehending the objective order of the world, of solving the problems of existence, and of a redemption from the many unnecessary evils of life. The intellect is truly the organ in which God, the authority of moral conduct, the standard of truth, the norm of the laws of nature, reveals himself. The intellect distinguishes humanity from the brute creation, for the beast is possessed of sentiment and joy of life (sometimes even of noble sentiments) just as much as man, and the intellect alone can pave the way of progress. Even in the field of sentiment and ethics, it is the guidance of the intellect that can improve the will and ennoble man's feelings and purify his religion. Neglect to cultivate the intellect and man will return to the savage state.

In the etymological meaning of the term the philosophy of science is the true pragmatism. It is pragmatic, if pragmatism means that the truth must be tested by practical experience. But pragmatism as propounded by Professor James antagonizes rationalism, monism and the philosophy of science.

Being opposed to theory, to the principle of consistency, to monism and to any unity or systematization, pragmatism drifts into pluralism as surely as a disintegrated soul will develop a multiple personality. The result will be a realism, a clinging to the facts—not objectively assured facts, but facts of an uncritical experience, facts, as mirrored in a purely subjective interpretation of sentiment. Such is pragmatism, the philosophy of personal equation!

EDITOR.

A POSTSCRIPT ON PRAGMATISM.

IN COMMENT ON PROFESSOR JAMES'S REVIEW OF MARCEL HEBERT'S BOOK.*

WHILE reading the proofs of the article "The Philosophy of Personal Equation," and preparing the present number for the press, I received from Professor James his reply to Marcel Hébert who he thinks suffers from "the usual fatal misapprehension" of the critics of pragmatism. It is strange that all his critics agree in misinterpreting Professor James's conception of truth. He says:

> "How comes it, then, that our critics so uniformly accuse us of subjectivism, of denying the reality's existence? It comes, I think, from the necessary predominance of subjective language in our analysis."

In my critique of pragmatism (*Monist*, XVIII, 320) I have anticipated Professor James's complaint and have therefore avoided recapitulating his views, but always quoted him in his *ipsissima verba*, and if words mean what they say, Professor James is decidedly to be blamed if he has been uniformly misunderstood. I request our readers to go over the definitions given by Professor James himself, and look them up either in my quotations or, better still, in his own book, *Pragmatism*. He says:

* *Le pragmatisme et ses diverses formes anglo-américaines.* Reviewed in *The Journal of Philosophy, Psychology and Scientific Methods*, Dec. 3, 1908.

"The true is the name of whatever proves itself to be good in the way of belief, and good, too, for definite, assignable reasons." —*Pragm.* p. 76.

" 'What would be better for us to believe'! This sounds very like a definition of truth."—*Pragm.*, p. 77.

"You can say of it then either that 'it is useful because it is true' or that 'it is true because it is useful.' "—*Pragm.*, p. 204.

"A new opinion counts as 'true' just in proportion as it gratifies the individual's desire to assimilate the novel in his experience to his beliefs in stock."—*Pragm.*, p. 201.

"An idea is 'true' so long as to believe it is profitable to our lives."—*Pragm.*, p. 75.

I could continue quotations from all the chapters of Professor James to prove that the language he uses must actually induce his critics to believe that his conception of truth is subjective. But, in his reply to Professor Hébert he says:

"This subjectivist interpretation of our position seems to follow from my having happened to write (without supposing it necessary to explain that I was treating of cognition solely on its subjective side) that in the long run the true is the expedient in the way of our thinking much as the good is the expedient in the way of our behavior! Having previously written that truth means 'agreement with reality,' and insisted that the chief part of the expediency of any one opinion is its agreement with the rest of acknowledged truth, I apprehended no exclusively subjectivistic reading of my meaning."

Judging from this explanation of Professor James, pragmatism agrees after all with the time-worn definition of truth as an idea in agreement with reality. And yet Professor James has declared again and again that pragmatism proposes a new definition of truth. Yea he denies that there is any explanation of truth except in pragmatism. He says in the present review:

"Ours is the only articulate attempt in the field to say positively what truth actually *consists of.*"

He italicizes "consists of" to distinguish it from his former definition of truth as "agreement with reality." If we trust him, no one before the appearance of pragmatism had ever a clear idea of what is meant by truth. Especially are his "denouncers" rebuked. He says of them:

"For them, when an idea is true, it *is* true, and there the matter terminates, the word 'true' being indefinable. The relation of the true idea to its object, being, as they think, unique, it can be expressed in terms of nothing else, and needs only to be named for any one to recognize and understand it. Moreover it is invariable and universal, the same in every single instance of truth, however diverse the ideas, the realities, and the other relations between them may be."

The denouncers of Professor James must have strange ideas of truth, for to them, even if "the ideas, realities and other relations" are different, truth remains the same "invariable and universal." I am unfortunate enough never to have seen such use of the word truth, but let us hear what the truth "consists of" according to Professor James. He continues:

"Our pragmatist view, on the contrary, is that the truth-relation is a definitely experienceable relation, and therefore describable as well as namable; that it is not unique in kind, and neither invariable nor universal. The relation to its object that makes an idea true in any given instance, is, we say, embodied in intermediate details of reality which lead towards the object, which vary in every instance, and which in every instance can be concretely traced. The chain of workings which an opinion sets up is the opinion's truth, falsehood, or irrelevancy, as the case may be. Every idea that a man has works some consequences in him, in the shape either of bodily actions or of other ideas. Through these consequences the man's relations to surrounding realities are modified. He is carried nearer to some of them and farther from others, and gets now the feeling that the idea has worked satisfactorily, now that it has not. The idea has put him into touch with something that fulfils its intent, or it has not."

I have quoted this passage in full lest there be any misunderstanding, and here Professor James says explicitly, "The chain of workings the opinion sets up is the opinion's truth, falsehood, or irrelevancy." And then the man "gets now the feeling that the idea has worked satisfactorily, now that it has not."

Here we have two definitions of truth side by side, one is agreement with reality, the other, specifically called "what truth actually consists of," is "the chain of workings which an opinion sets up." It must be noticed that an opinion is not truth and that the application of an opinion to practical life is still less the truth, whether or not it works satisfactorily.

In fact sometimes a positive lie works decidedly satisfactorily. We must remember that ideas are potent factors in the history of mankind. If certain errors are helpful to me it may be to my own profit to spread them and make people believe in them. When by special couriers Rothschild learned of Napoleon's defeat at Waterloo in 1815, he spread the report through his agents that the French had gained a decisive victory over the allied troops. His own bank began ostentatiously to buy French and sell Prussian consols, but secretly was performing the reverse transactions to a much greater extent. He succeeded in spreading the untruth and it worked satisfactorily and yet we cannot say that thereby it became a truth. Undoubtedly "the idea had put them into touch with something that fulfilled its intent." There was a chain of workings set up, and to the man who pressed the button it worked as calculated.

The idea and the action which it starts (at least so it appears to me) are two different things which in all circumstances have to be kept asunder. I know very well that Professor James has in mind other chains of workings, but any impartial reader will grant—perhaps he himself

will concede—that he uses his words very indiscriminately and in his definition he follows the impulse of the moment.

Some of Professor James's critics seem to have confused the ideas truth and reality, and when noticing the subjective trend in his definition of truth have thought that he had denied the existence of reality outside. He expressly states that he believes in realities and so there need be no quarrel about it, although to him realities are only "objects believed in." Professor James says:

> "Since the only realities we can talk about are such objects-believed-in, the pragmatist, whenever he says 'reality,' means in the first instance what may count for the man himself as a reality, what he believes at the moment to be such."

According to this definition, the vision of a dreamer if it is only believed in, is a reality,—of course we must add, "to him," and "at the moment." It may not be a reality to others or to him at another time. Under these circumstances had we not better avoid the phrase "reality to him" and offer in its stead a definition of reality without any qualification, and in contrast to such realities as are *mere* objects believed in?

Professor James is a pluralist, and everywhere he sees the many where scientific method requires us to single out those features which are typical and universal. He further demands the verification of truth by the senses, the reality must be "felt" to be verified.

Mr. Charles S. Peirce showed in articles published about thirty years ago, that there is a certain stage in man's development in which he has not yet an adequate conception of truth, nor does he care to discover the truth. What he cares for is merely a settlement of doubt. Doubt is a state of disturbed equilibrium which causes uneasiness. Doubt must be removed in one way or another and Mr. Peirce calls the settlement of doubt very appropriately, "the fixation of belief." Professor James has confessed

that this same article of Mr. Peirce has influenced him in the formation of his philosophy of pragmatism, and we cannot help thinking that Professor James calls truth what in Mr. Peirce's language is merely "the fixation of belief." Lest we are accused of misrepresenting Professor James's position we will without any further comments quote the following passage in which he answers his critics:

"Sometimes the reality is a concrete sensible presence. The idea, for example, may be that a certain door opens into a room where a glass of beer may be bought. If opening the door leads to the actual sight and taste of the beer, the man calls the idea true. Or his idea may be that of an abstract relation, say of that between the sides and the hypothenuse of a triangle, such a relation being, of course, a reality quite as much as a glass of beer is. If the thought of such a relation leads him to draw auxiliary lines and to compare the figures they make, he may at last, perceiving one equality after another, see the relation thought of, by a vision quite as particular and direct as was the taste of the beer. If he does so, he calls that idea, also, true. His idea has, in each case, brought him into closer touch with a reality felt at the moment to verify just that idea. Each reality verifies and validates its own idea exclusively; and in each case the verification consists in the satisfactorily-ending consequences, mental or physical, which the idea was able to set up. These 'workings' differ in every single instance, they never transcend experience, they consist of particulars, mental or sensible, and they admit of concrete description in every individual case. Pragmatists are unable to see what you can possibly mean by calling an idea true, unless you mean that between it as a *terminus a quo* in some one's mind and some particular reality as a *terminus ad quem,* such concrete workings do or may intervene. Their direction constitutes the idea's reference to that reality, their satisfactoriness constitutes its adaptation thereto, and the two things together constitute the 'truth' of the idea for its possessor. Without such intermediating portions of concretely real experience the pragmatist sees no materials out of which the adaptive relation called truth can be built up."

Professor James speaks also of Professor Schiller of Oxford endorsing his views. He says: "Schiller's doctrine and mine are identical, only our expositions follow different

directions." Of Schiller's conception of truth, Professor James says:

"To be true, it appears, means, for that individual, to work satisfactorily for him; and the working and the satisfaction, since they vary from case to case, admit of no universal description. What works is true and represents a reality, for the individual for whom it works. If he is infallible, the reality is 'really' there; if mistaken it is not there, or not there as he thinks it. We all believe, when our ideas work satisfactorily; but we don't yet know who of us is infallible. Schiller, remaining with the fallible individual, and treating only of reality-for-him, seems to many of his readers to ignore reality-in-itself altogether. But that is because he seeks only to tell us how truths are attained, not what the content of those truths, when attained, shall be. It may be that the truest of all beliefs shall be that in transsubjective realities. It certainly seems the truest, for no rival belief is as voluminously satisfactory, and it is probably Dr. Schiller's own belief; but he is not required, for his immediate purpose to profess it. Still less is he obliged to assume it in advance as the basis of his discussion."

It is astonishing how Professor James ignores the most obtrusive facts of the history of philosophy. To him the pragmatic "is the only articulate attempt in the field to say positively what truth actually consists of," and he assumes that the opponents of pragmatism never thought about truth. In his opinion they simply claim that "when an idea is true, it *is* true, and there the matter terminates." And with this blank in his information concerning all that has been done in the determination of the nature of truth, he starts the world over again and repeats the errors of the sophists which characterize the pre-Socratic period, the very beginning of the history of philosophy. Note at the same time in the pragmatism of Professor James the exaggerated significance of the part which the senses play in the determination of truth. In a passage just quoted, Professor James emphasizes the word "felt" as if a feeling of fitness were the essential element in the constitution of

truth. He describes the process of discovering truth by saying that "his idea has in each case brought him into closer touch with a reality felt at the moment to verify just that idea." Note here how he clings to the particular, "in each case," and "felt at the moment," and it must be "just that idea." Nor is it enough to use the word "felt"; he also speaks of "touch." So much is he afraid to trust the mental process which would lead him to the universal.

Truth is not of the senses but of the mind. The senses never produce either truth or untruth; it is our faculty of the purely formal (commonly called reason) that works out judgments that are either true or untrue, and we verify these judgments by exactness in the application of logic, arithmetic, geometry, etc. The senses only furnish the data; and if the senses are not sufficiently guided they yield very unreliable results, in evidence of which we refer to so-called sense illusions.

To the pragmatist, truth is always particular, and in the statement endorsed by Professor James, Professor Schiller even goes so far as to say that truths "admit of no universal description." There are many indications that pragmatism cannot distinguish between facts and truths, and this is one of them. We must remember that a statement of fact may be true, but it is not a truth. A truth is always a formulation of the essential features of a set of facts. Truths are not concrete realities, but ideas that appropriately describe certain characteristics of realities, so as to make our anticipations tally with experience in the past and present and even in the future. While facts are always particular, truths are always general; facts are verified by the senses, truths by the mind; facts change, truths (if they were ever real truths and not errors) remain true forever.

We grant that the way to truth is mostly by approximation, and frequently passes through errors. Yea, these

errors are sometimes stoutly believed in with great tenacity and are even forced upon unbelievers by such drastic arguments as dungeon and fagots, but this vigor of conviction never changes them into real truths.

Since Professor James endorses the old definition of truth, apparently forgetful of other utterances he has made, we might come to the conclusion that pragmatism (formerly vaunted as a novel theory of truth) is nothing new after all, and that its sole claim to originality consists in the emphasis laid on the practical application of truth, without which truth is not yet truth were it not for the fact that philosophers and educators from the time of Socrates to the present day have insisted on this point almost *ad nauseam*, so as to make the doctrine that truths must be verified by experience and applied to practical life, trite.

It appears that pragmatism is still in a plastic state, its doctrines are not yet matured and cannot be expected to be consistent; they are developing under our eyes. There is reason to hope that when it has attained years of discretion its conception of truth will look very much like that of the old philosophers, now so ostentatiously decried by our pragmatist friends.

We oppose pragmatism as a philosophy and we criticize its conception of truth. But for all that, we find the movement very interesting and instructive. If pragmatism would not lay claim to being a new philosophy, but if it would merely be a psychological method of determining the establishment of truth in the several philosophies by evaluating the purposes and tendencies under which a philosophy has been formed and taking into consideration the personal equation of the several thinkers, we would recommend it as an extremely practical and useful method. The public at large is too apt to overlook that the purpose of science is its practical application. Man is not a purely intellectual animal. His intellect, including all the truths

he can establish, serves the purpose of enhancing his life. Accordingly the most important part of every philosophy will always be its pragmatical aspect, and this is a truth which has been recognized since time immemorial, except that now and then it is forgotten. The easiest way to reconstruct the several philosophies of past ages will be to point out the needs of the generation, the duties with which it was confronted, the tasks which had to be performed, and if we bear these practical points in mind we are not likely to misunderstand if in one period emphasis is placed on one special aspect of the truth, while at another the very opposite may come to the fore-ground. And this is true mainly in those branches of philosophy which are of a practical nature, ethics, pedagogy, religion, the policy of the churches, political economy, etc. Pragmatism as a philosophy is an evidence of this. In emphasizing the practical significance of truth, it goes so far as even to deny the value of theory, of consistency, systematization, etc., and when taken to task, Professor James naively declares that the old definition of truth has to be taken for granted.

EDITOR.

THE CLASSIFICATION OF RELIGIONS.

[CONCLUDED.]

IV. According to their Usual Names, Locations, and Numbers of Adherents—Geographical and Statistical Method.

THE last was the method of time. This is that of space. In this, religions are measured and compared according to extent or quantity. At first thought, this is an absurdity; yet like all the others it may teach its lesson. Coupled with careful ethnological study, it is likely to become of great importance. Its virtues do not lie in the way of teaching the quality or superiority of religions, as the argument of number is so often used. Numbers are never a mark of right and goodness, nor can they tell us the right way in the higher things of morals and religion. Notwithstanding this, they are always interesting, and they may be of inestimable use in showing how tendencies have carried themselves out, how principles have affected men, by what sort of principles they have been moved, and to what extent; and these teachings coupled with a knowledge of the circumstances in which the given peoples were placed and of the stage of their mental development when the principles became operative, may teach much concerning the methods and laws of human progress. Moreover, maps and figures may show us the strength of principles, doctrines, and tendencies whose nature we already know; and if we can procure good charts and fairly well authen-

ticated enumerations of our own and former ages, we may obtain a vastly clearer and better impression of the march of these principles and doctrines through the world both in reference to space and time. To see plainly the condition of things at various periods in time, is to grasp the process of the evolution and transformation of human ideas. Finally, I must say that such an attempt is in accord with the spirit and aim of the most advanced methods of teaching in history and physical science. It falls into line with those ideals which in these modern times have filled huge buildings with specimens of every sort ranging through the three kingdoms of nature—animal, vegetable, and mineral; which equip great institutions with every conceivable sort of mechanical device for illustrating the laws of the physical world; which spare no expense to establish bureaus of statistics and to report everything supposed in any way to have a bearing in illustrating the conditions and tendencies of nations; and which establish signal service stations and geographical institutes in which the changes in the kingdoms of the heavens above and the earth beneath may be accurately observed and duly represented by chart and statistics.

1. GEOGRAPHICAL DISTRIBUTION.—To completely present to the eye the religious condition of the world through geographical relations one would need a series of "dissolving maps" representing the changes, transformations, and extensions of religions from the earliest dawn of the sentiment in human minds down to the present day. From lack of such a desideratum we shall have to extemporize what illustration is possible by means of maps of this and other periods. The means are exceedingly scarce and the periods chosen for illustration must consequently be few.

(1) *About 1880.* For the geographical extension of the various principal religions at the present time I will

refer to maps and tables in *Meyer's Hand-Lexikon,* II, p. 1611; Berghaus's *Phys. Atlas,* Abt. VII, iii, No. 63; and Droysen, *Historischer Hand-Atlas* (last map). According to these best and latest reliable authorities which I am able to find, the extent of the various faiths may, with some limitations and modifications, be stated as follows:

Shamanism, the highest development of the so-called savage religions, has chief possession of the mind in Africa between 10 degrees north and 20 degrees south of the Equator, in Northern Asia, Northern North America, and Central South America.

Brahmanism (or better Hinduism) is now limited to the Aryans in Eastern and Southern Hindustan.

Buddhism, in variously modified forms, extends from the middle of the Malacca Peninsula northward including Siam, Anam, Birmah, Nepal, Thibet, Kashmire, China, Mongolia, Corea, into many islands of the Pacific, especially Japan, Formosa, and the Philippine group, parts of other East India islands, the whole of Ceylon, a numerous following in Bactria, scattered representatives in Siberia, and some 107,500 votaries in South-Eastern Europe.

Mohammedanism is territorially very wide spread and shows evidence of great vitality and activity at the present time. Its control is well-nigh complete from Arabia eastward over Persia, Belloochistan, Afghanistan, East and West Turkestan, the Kirgis Steppe; and westward over Syria, Asia Minor, Turkey; the whole of Northern Africa including Egypt, Nubia, Tripoli, Fezzan, Tunis, Algeria, Morocco, the Sahara and Sudan regions; the East Coast including Somali, Galla, and Zanzibar; in the East Indies, Sumatra, Java, Borneo, Celebes, and the south half of Malacca; and a considerable representation in Hindustan and Birmah.

Christianity has three great divisions: Greek (or Oriental), Roman Catholic, and Protestant.

Greek Christianity prevails almost entirely in Russia, Roumania, Montenegro, Servia, and Greece; to a considerable extent also in Turkey, Hungary, Caucasia, Armenia, Siberia, and Abyssinia.

Roman Catholicism has yet by far the widest sway. It is the all prevalent form in Austria, Italy, Spain, Portugal, France, Bavaria, Baden, Alsace-Lorraine, Belgium; numbers about two-fifths in Holland and the German Empire; about one-half in Switzerland; prevails again in Mexico, Central America, Columbia, Equador, Venezuela, Guiana, Peru, Bolivia, Chili, Argentina, Uruguay, Paraguay, Brazil, Hayti, the Spanish and French West Indies, the African islands in the Atlantic and Indian Oceans; numbers from 150 to 400 in every thousand inhabitants of Great Britain and Ireland, British America, United States, Australia, New Zealand, and Polynesia; and has scattering missions elsewhere.

Protestantism, in some of its many varieties, is the chief faith in Great Britain, Denmark, Norway, Sweden, Finland; enumerates three-fifths in Germany and Holland; a little more than one-half in Switzerland, British America, Dutch and Danish West Indies; four-fifths in British West Indies, United States, and Greenland; more than half in British South Africa, Transvaal and Orange River Republic; nearly one-third in Madagascar and Polynesia; nearly seven-tenths in Australia; and very scantily successful missions in parts of Asia and Africa (the most numerous not exceeding 7 converts to every 1000 inhabitants of the region).

(2) *About 1500 A. D.** For this and other past periods I have not been able to find published maps. Hence there was no choice but to extemporize the study. To do this roughly from historic data is not a very difficult

* See also historic maps of the period.

task. I have therefore made this sketch to show the religious condition of the world at some of the great epochs in religious history. We may say in general that at the year 1500 there was no Protestantism, America was unknown to Europeans and belonged to the Indians, Mohammedanism had reached its arm into South-Eastern Europe but had not pushed far southward into Africa nor far eastward into Asia, while the Orient was scarcely known, though its conditions were then nearly what they are now. We may sum up the distribution in general thus:

Romish Christianity occupied Europe west of Russia, Turkey and Greece.

Greek Christianity covered South-western Russia, parts of Turkey, Greece, Asia Minor, Northern Egypt, and Abyssinia.

Mohammedanism had just been expelled from Spain, and now ruled the north coast of Africa, Arabia, Persia, Asia Minor, parts of Turkey, scattering peoples to the east of the Caspian Sea, and to a considerable extent into Northern India.

A Modified Brahmanism took the place of the ancient faith in the unsubjugated parts of Aryan India, while Buddhism had for a couple of centuries been expelled.

Buddhism itself had spread everywhere east and north into Farther India, Thibet, China, Corea, and Japan.

Of the rest of the world,—America, Africa, Australia, and Polynesia,—we can only conjecture from their later character and the fact that their ideas in all the fields of civilization were very slow to move.

(3) *About A. D.* This marks another of those great epochs in which transformations begin. We have a very different religious world to picture to ourselves. There was as yet no Christianity, no Mohammedanism, and Bud-

dhism had not traveled to Thibet, China, or Japan. Then too, many of the old faiths were still living.

Judaism was limited to the little Roman colony of Palestine.

Zeus and Jupiter were yet reigning, but with enfeebled power in Greece and Italy.

Odin and Thor inspired and checked the fierce hordes of Teutons north of the Alps.

The Celtic Druids managed the faith of the Britons.

Osiris and Isis were sinking into oblivion in Egypt.

Ahura Mazda, although temporarily weakened by assaults from the West, yet commanded the reverence of most Persian hearts.

Buddhism had won the ascendency in India from Punjab to Ceylon.

Confucianism held well-nigh unmolested sway in China.

Of the rest of the world we know nothing, except what archæology is beginning to reveal.

(4) *About 400-500 B. C.* Here we stand on the threshold of one of the greatest epochs in history. Mighty changes were soon to be effected in various parts of the world. New tendencies of mind and morals are being born, and the political face of the world is putting on new aspects. The center of political power is in the Medo-Persian Empire, which is now at its height. Greece too has reached the acme of its glory and receives an irrecoverable blow from the monarch of the East. The Roman Republic (yet very small) has just started on its stormy and brilliant career. The Jews have been carried into captivity. Babylon and Nineveh are falling. Socrates (470-399), Buddha (560-480), and Confucius (550-478) are now living and have begun to turn out the past and usher in the future. Surely change on a great scale was taking place in men's spirits when in three such widely

sundered regions as China, India, and Greece, the conditions had become such that minds like these could and must be developed. Two things are suggested. First, the religious notions of the past were so old as to be worn out. Then again, the nature conditions of the past had reached a stage where higher moral ground was possible, was necessary. In these great personalities we have the mouth-pieces of the higher things ready to be spoken in those lands. Here were crises of opportunities which floated men into eternal fame. In other lands, before and since, has the like occurred. In Persia, ages before this the old religion died and the new was spoken by Zarathustra. In Palestine ages later the old formalistic Judaism was to be set away into obscurity by the living practical moral gospel of Jesus. In Arabia, after still farther ages, the old nature worship and animism was to be replaced through Mohammed by the call to Islam (Salvation) and the worship of Allah alone.

2. *Statistics.*—The enumeration or estimate of the number of adherents to the various religions is a work as yet beset with insuperable difficulties. In the first place, there is no reliable census taken among more than half the peoples of the globe. Of the 1540 millions estimated to be living at present, only 700 millions may be considered as counted fairly well. A people must have reached a very high social stage of civilization before the census sense becomes operative, and some of those who would be supposed from their development otherwise to have an interest in knowing their numbers, etc., seem to have none. When besides the so-called savage and barbarous world, which includes the natives of America, Polynesia, Australia, most of Africa, and Northern Asia, is added the indifference of many of the civilized nations, the difficulty begins to show its greatness. As an illustration or two of the latter, I might remark that the population of Constantinople is

not known, and the census of Cuba has never been carefully taken.

Then as to the question of making estimates, there are double and triple uncertainties. First, in many of these uncounted regions the population is so changeable from time to time as to defy even respectable estimates. The nomadic and emigrating tendencies of many peoples are things hard to take into consideration. They are in this way liable to be counted twice or not to be counted at all. This is further increased by the wide-spread practice of kidnapping slaves and wives. Other factors, are the great variations of populations produced by unequal birth rates. Professor Ratzel of Leipsic cites the case of a single small village in Bavaria of which he examined the baptismal records for a period covering some 250 years, and found variations in the number of births from 170 to 38 for different decades with an almost invariable village population. Many examinations of this kind go to show that increase of populations, among other things, depends much on the outlook of the people. Besides this to-a-large-extent-unconsciously sterile or prolific tendency, there are the facts of infanticide and suicide, both of which prevail at times to an unbelievable extent among some nations. Again, there are various races, which through contact with higher civilizations and from other causes, are in a state of constant decline in numbers. Some have already died out entirely (Tasmanians, etc.); others are fast decreasing (Indians, Maori, etc.). And lastly, three of the mightiest factors having to do with this uncertainty and variation in the world's population, are famine, pestilence, and war. In some lands and at some times the proportion is very greatly disturbed by these. Happer, an English writer on the Chinese, tells of 63,000,000 having perished by hunger since 1812. And some one (Meadows I think) says that 30,000,000 Chinese perished in a single rebellion.

In India the populations of certain regions are occasionally terribly reduced by either famine or cholera. War not infrequently decimates the male population and seriously disturbs the naturally balanced numerical relations of the sexes. These factors put together go to show that there might be such a science as the pathology of population.

When to all these difficulties in the formation of estimates of the numbers living either now or in the past, is added the variations in the actual estimates made by travelers and investigators, the case begins to look like a hopeless one. How great this confusion may threaten to be, may be better appreciated if I state, that the population of China has during recent years been variously calculated from 150 to 450 millions. The most reliable figures, however, range between 370 and 420 millions, the latter being the sum given by Tseng, a Chinese statistician. (In A. D. 57 China had 21 millions.)

But to come closer to the question of calculating the votaries of the different faiths of the world, it must be observed that the problem would be far from solved even if we could count the peoples of the various lands, though enumeration on the best approximation of these is the only result yet or perhaps ever possible. Statistics of religion in general can do no more than collect the aggregates of population in various lands and divide the sums among the faiths supposed to predominate in those various regions. But this is almost the loosest sort of generalization, and has no solider basis than the assumption that peoples living under the same general environment and in the regions where certain doctrines have been extensively preached, must have the same religious outlook. The assumption has some truth on its side. Such peoples must necessarily have more in common and possess a greater similarity of theory and practice than those who are widely separated and who are surrounded by very different cir-

cumstances of life. Yet this assumption and method, without qualification, leave no room for the play of individuality. Though the intelligent thinking Chinaman is far nearer the religious point of view of Buddhism than he is of Protestant Christianity, and though the scientifically inclined European or American is probably more in sympathy with the latter than he is with the former, yet it is straining the category of either name to class such men with the mass of their countrymen who subscribe to these confessions and their ordinances. And this class of non-conformists in all civilized countries, though never conspicuous or exactly ascertainable, must be somewhat numerous, the more so in proportion to the liberty and intelligence of the people. Hence when it is stated that the number of Christians or Buddhists is so and so, we perceive the necessity of discounting the estimate to a considerable extent from this reason alone. I should remark in passing, that the inaccuracy of religious statistics in failing to represent the individualism and independence of many, may be and is in part remedied in what we term sectarian statistics. Yet this can never appear in those general estimates of the religions of the world, and consequently our cautions remain in full force. We must further make the perhaps yet greater deduction of that multitude of indifferent persons to be found everywhere. Almost every neighborhood numbers its scores who give little or no attention to the question of religion in any of the usual senses. These two classes in the aggregate seriously diminish the accuracy of our customary estimates. Nevertheless we must make them as best we can, and learn from them what we may.

The most remarkable interest in the scientific study of religions and of religion was manifest in the period between the later 70's and the early 90's of the nineteenth century. The labors accomplished by Max Müller, Rhys Davids, Tiele, Sayce, Bournouf, Kuenen, Whitney, Spencer, Pflei-

derer, Brinton, Réville, Johnson, Carus, and their many co-workers, began another epoch in religious history. The influence of this work brought about the World's Congress of Religions at Chicago in 1893; and its continuation in a hundred ways is steadily modifying the religious outlook, not only of Christendom but of the peoples who have for centuries held to the other historic faiths.

(1) *T. W. Rhys Davids,* the eminent English Oriental scholar and authority on Buddhism, gives the population of the world and of the various religions as follows. (See his *Buddhism, etc.*)

RELIGIONS	NUMBERS	
Jews	7,000,000	
Mohammedans	155,000,000	
Greek Christian	75,000,000	
Roman Catholic Christian	152,000,000	327,000,000
Protestant Christian	100,000,000	
Brahmanism	160,000,000	
Buddhism	500,000,000	
Parsees	150,000	
Sikhs	1,200,000	
Heathen	100,000,000	
	1,250,350,000	

(2) *The Justus Perthes Geographische Anstalt* of Gotha, one of the highest statistical authorities in the world,

RELIGIONS	MILLIONS		PER CENT	
Christians		445		30.2
Catholics	200		13.6	
Protestants	150		10.2	
Greek Orthodox	87		5.9	
Others	8		0.5	
Mohammedans		170		11.5
Israelites		7		0.5
Heathen		852		57.8
		1474		100.

gives the preceding figures. (See *Taschen-Atlas*, 22. Aufl. von Hermann Habenicht. Mit geogr.-stat. Notizen [by H. Wichmann], 1886.)

In this connection I will give for future reference the same authority's figures on the numbers of the principal races of the world.

RACES	MILLION	PER CENT
African and Semites	176	11.9
Oceanic	33	2.2
American	10	0.7
Dravidian	40	2.7
Mongolian	586	39.7
Indo-European	631	42.8
	1476	100.

(3) *From G. Droysen's Historischer Hand-Atlas*, 1886, a most excellent outline work, I take the following estimates (p. 92).

RELIGIONS	NUMBERS
Christians	442,351,000
Mohammedans	186,356,000
Buddhists	447,969,780
Brahmanists	187,947,450
Heathen	92,182,340
	1,356,806,570

(4) *Meyers Hand-Lexikon* (3. Aufl., 1885) gives a careful statistical analysis of the general religious condition of the world drawn from the most recent enumerations and estimates. In the following summary I have divided the 687 millions set down there as the "worshipers of Brahma and Buddha" into four groups, viz., Hinduism, Parseeism, Sikhism, and Buddhism, leaving the total the same, while putting for the three latter the numbers given by Rhys Davids (II, p. 1611).

RELIGIONS	MILLIONS	
Protestant Christianity	131	
Roman Catholic Christianity	210	433
Greek Christianity	92	
Judaism	$6^{12}/_{20}$	
Mohammedanism	196	
Hinduism	$185^{13}/_{20}$	
Parseeism	$^{3}/_{20}$	$1018^{4}/_{20}$
Sikhism	$1^{4}/_{20}$	
Buddhism	500	
Others	$128^{12}/_{20}$	
		$1451^{4}/_{20}$

(5) A later estimate (culled from various sources, but not so carefully discriminated) is found in a *Beilage* to the *Allgemeine Zeitung* for January, 1901. Some of the results of this estimate are given in *Appleton's American (Annual) Cyclopedia*, 3d Ser., Vol. VI, (for 1901).

RELIGIONS.		ADHERENTS.
Christians		501,600,000
Roman Catholics	240,000,000	
Protestants	163,300,000	
Greek Catholics	98,300,000	
Mohammedans		167,200,000
Jews		7,100,000
Pagans (largely Buddhist and Brahmin)		667,800,000
Heathen (Savage)		95,400,000
		1,439,100,000

The same authority gives the world's population as 1,544,509,000.

The figures for the adherents of Roman Catholicism are given by Mulhall in 1898 as 200,450,000.

The Jewish Year Book for 1902 gives the total number of Jews in the world as 10,378,530.

The official estimate of the Turkish government gives the total number of Mohammedans in the world as 176-

000,000 for about the year 1900; while Mr. Mann in the *North American Review,* 1900, increases the sum to 200-313,845.

This result I have used in another way to make an object lesson. If a surface be laid out with 38$\frac{2}{20}$ units on each side, it will contain 145$\frac{12}{20}$ square units. By using different colors and coloring as many squares as each religion has millions of adherents, their comparative followings may be strikingly perceived at a glance.

C. CLASSIFICATIONS BASED ON PHILOSOPHIES OF RELIGION. SUBJECTIVE.

1. *Professor Pfleiderer* of Berlin, in a work entitled: *Die Religion, ihr Wesen und ihre Geschichte* (2 Bände, 1869), developed a division of which he said: "Wir hoffen, dass diese Einleitung der Religionen überhaupt und der heidnischen insbesondere sich durch die Verbindung geschichtlicher Treue mit begrifflicher Schärfe von selbst empfehlen, und dass sie auch vor der strengsten Kritik jener Empiriker, welche gegen jedwede begriffliche Schematisirung stets misstrauisch sind, standhalten werde." (II, p. 60.) He bases it on an attempted psychological analysis of the fundamental principles of religion, the ground basis of piety. Here is to be sought the one underived reality to which all else is accidental. The reason that previous divisions have proved untenable is, according to Pfleiderer's mind, that they have been based on secondary phenomena instead of being founded in the essence of religion itself. In such divisions there are always certain points which will not stand the pressure of the facts. But he says: "Die Leichtigkeit hingegen, mit welcher hier der geschichtliche Stoff sich subsumirt unter den begrifflichen Schematismus, ist ein Beweis für die Richtigkeit des Eintheilungsprinzips, also schliesslich noch ein Beweis für die richtige Fassung des Begriffs der Religion, wel-

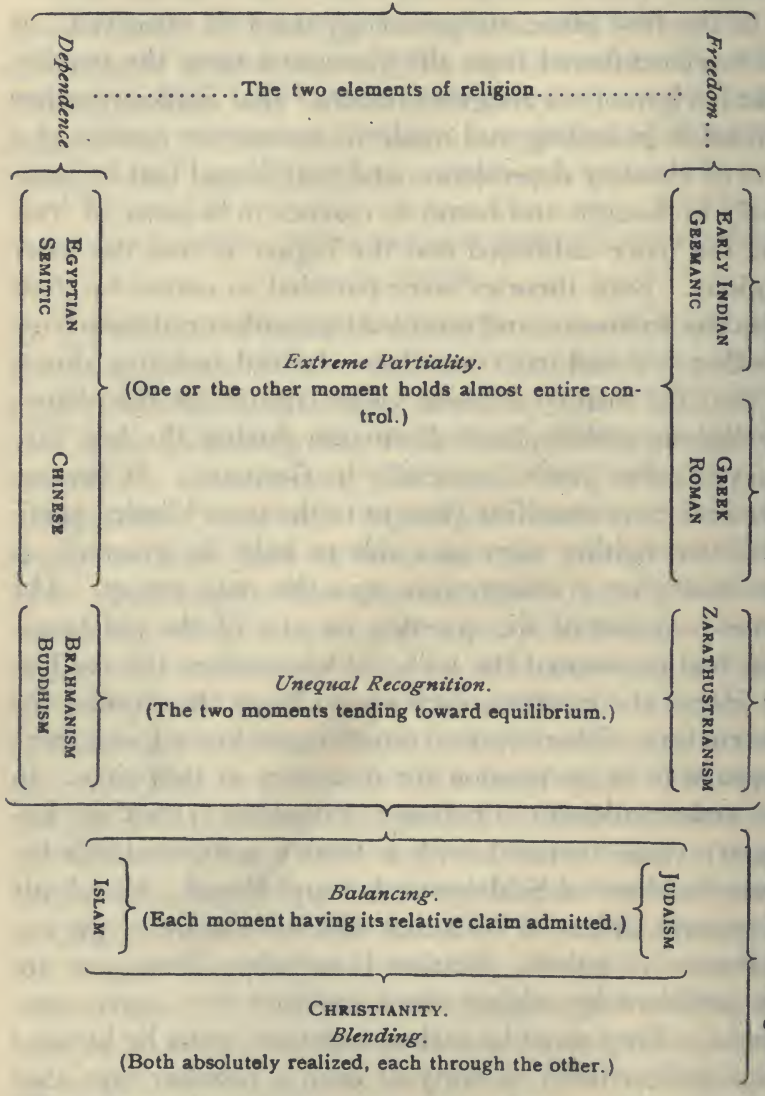
chem das Eintheilungsprinzip entnommen wurde." Here is confidence enough. It should indeed be an excellent theory to warrant so much. We will look at it and hear its later fate. (See Chart.)

In the first place, its geneology must be observed. It will be remembered from the discussion upon the psychological origin of the religious nature,* that Schleiermacher founded it in feeling and made its essence to consist of a sense of absolute dependence, and that Hegel laid its basis wholly in thought and found its essence to be sense of freedom, the more unlimited and the higher it rose the more religious. Both theories were paraded to excess by their respective followers, and received the hardest criticism from the other side and from outsiders. Indeed, one may almost say that the history of these views constitutes the history of religious philosophical discussion during the last fifty to seventy-five years, especially in Germany. It became more and more manifest (except to the most blinded partisans) that neither view was able to hold the ground. A new theory or a compromise was the only resort. The former was out of the question on any of the old bases. Kant had preempted the will, Schleiermacher the feeling, and Hegel the intellect, each severally as the ground for his structure. There was no other region known, and there happened to be no passion for discovery at that time. In this embarrassment Professor Pfleiderer (then at Tübingen) came forward with a theory compromising between the views of Schleiermacher and Hegel. He admits the ground claims of both, but will have none of the exclusiveness of either. Neither is complete alone, nor are they sufficient by adding them together in a mere compromise. They must be melted together, must be blended into a perfect unity, a unity of such a peculiar type that neither looses its essential character, while each mutually

* See *How Religion arises—A Psychological Study*, by Duren J. H. Ward.

admits the exercise of the other to the fullest extent; indeed, each in this fullest exercise of the other comes to get in

PFLEIDERER'S PHILOSOPHICAL CLASSIFICATION OF RELIGION.



this way, and in this way only, its own fullest play and activity. This is truly a great insight. Such a work were

as really a discovery as the development of the onesided views which it wrought into a higher view.

He lays out the ground somewhat as follows: "Das Wesen des frommen Selbstbewusstseins an und für sich" is the only factor conceivable for a sharp or exact division. In this he finds two constituting moments: freedom and dependence. In and for themselves each claims full and unlimited sway. Hence arises conflict and struggle between them. The various relations growing out of these two moments of religious life form a comprehensible and sharply fixed basis of division. If in a religion one is predominant we see its essential characteristic, and so if the other; but if we see them standing in an equilibrium of validity, we recognize the approach to the perfect. Their unequal coexistence will be found to be the common characteristic of the heathen religions, while their greater balance is the chief mark of the monotheisms. These monotheisms again are divisible on the ground as to whether the two elements only relatively have their rights recognized, or whether this mutually recognized right becomes a completely blended realization. Christianity represents the latter, Judaism and Islam the former. In Christianity is the fullest freedom reached only when the fullest dependence is realized. (See 2 Cor. iii. 17, also Luke ix. 24.) Judaism and Mohammedanism hold to both of these elements, but in such a way as to resemble two poles which though inseparable yet stand over against each other in opposition. In these religions man feels himself free and also dependent, but the two are not so blended that he finds his freedom in his dependence, and at the same time the satisfaction of his own will in the service of God. In them the one moment leaves off when and where the other begins.

Not so in *Heathenism*. Sometimes an overpowering sense of dependence, sometimes an unlimited notion of free-

dom are the characterizing elements. Never are both recognized, never do they stand in equipoise, never do they blend in pious experience. Both being indestructible elements, neither is ever wholly lost, and even in greatest subjection, the unrecognized factor reacts with what weak powers it has left. Yet when vigorous reaction comes, it too is just as onesided. In the heathen mind these elements are so unbalanced that they do not stand as in Judaism merely out of and beside each other, but stand in a relation of opposition, of *againstness,* or of contradiction to each other. In this opposed way each is false from the other's point of view. One of the two chief tendencies will be taken by the religious mind on the stage of pure nature. Either man gives himself up entirely to his dependent sense, regards himself as on all sides determined and at the disposal of the Divine All-life, in which case the natural will seeks by the satisfaction of the natural impulses to compensate itself all the more because of this resignation. This accounts for the mixture of resigned self-sacrifice (asceticism) and gross sensuality in the pantheistic nature religions. On the other hand, man realizes his dependence little, an overflowing fulness of life gives an overpowering feeling of freedom from the control of the finite and limited gods of nature. He is, to be sure, in a measure dependent on them, since he prays for their help; but at the same time he thinks to compel them into his service through the craft or force of his magic and divine exorcisms. The real feeling of dependence now reacts in the fear of an unconditioned might standing yet higher than the gods, a blind necessity or fate. This is everywhere at the back of polytheism, hard and oppressive in proportion as the gods are believed to be limited. In the stage of development which precedes what we term the beginning of civilization, this contrast of freedom and dependence is at its strongest. With the entrance of a

higher social condition in the taking on of family and civic relations this sharp division is toned down somewhat. The individual begins, by the suggestions and incentives which these impose upon him, to recognize himself as belonging to a law-ordered whole. The sensuous will of man is restrained by custom and law till he feels his dependence on society, but at the same time he is lifted into a higher freedom in that to his previously selfish interest there is given now the greater content of a more universal aim, or interest. This filling out of the sense of freedom with moral content and the drawing of the sense of dependence toward moral powers (deities) gradually destroys the conflict between them. The Greeks or Romans who had received this moral and civic culture no longer feared that blind fate above the gods; but fate became to them gradually more and more the rational will of a Zeus who was the bearer of the natural world-order, or of a Jupiter Capitolinus who was the supporter of the Roman idea of the State. On the other hand, the cultured Chinaman, who before had been borne down by a stupid resignation to his complete dependence on the irrational life of nature, felt this no longer in the former way; but as the notion of his State-relations took hold on his life, his dependence recognized itself as leaning on an essentially rational whole. In both examples, however, the moral and civic relations are imperfect, their powers of influence are only relatively universal, hence the will in dependence on them does not arrive to a perfect freedom, i. e., the two do not become inwardly fully reconciled to each other. A third stage to be noticed in the cultivated nature religion, he calls the supernatural. This is where the deified powers are no longer the natural powers merely. A fundamental breach is made with nature, yet not to the extent that a positive supernatural world is attained, nor to the denial of all the old nature powers. There is spirit worship of the higher

sort along with many elements of nature-religion. Of this sort are Brahmanism and Buddhism on the one side, and Zarathustrianism on the other. Both have escaped the limits of the finite, in nature as well as the State, and are consequently to be distinguished from the previous stages. They form indeed a sort of pre-stage to a monotheistic religion. There is yet between them a contrasted onesidedness: since in the Indian religions the false dependence on the finite is broken by the release from sensuous self-torture (in Buddhism also of mental) without attaining to a positive freedom in the infinite; while in the Persian, though the freedom is placed as the absolute aim of divine things, yet it never reaches to the abolition of a dependence on the ungodly. The remnants of a former naturalism yet remain in its strong dualism.

* * *

Complete and invulnerable as the author's enthusiasm led him to boast his theory and classification to be, it was not complete enough to win his own assent a few years later. He has re-written the whole topic a couple of times since, and has finally himself abandoned the theory which was to have resisted the strongest criticism of opposing schools through its "combination of historical fidelity and exactness of comprehension." In his more recent work, *Religionsphilosophie auf geschichtlicher Grundlage,* he proposes another theory and a different basis of division. According to the view being here developed, he is as much at fault for abandoning this division as he was at first for making it and supposing it to be final. One would have to abandon each latest view on the same ground and in the same way, if he lived and remained as fertile and progressive minded as heretofore. The difficulty lies not so much in the great faultiness of the classification principle, but in supposing it could do the work of other classifica-

tions. For its legitimate purposes it is most excellent. One cannot look upon it carefully without being impressed with the amount of truth that it teaches. Like the other attempts which we have looked at, it has its importance. It is no fault of a theory that it is misused, or that unreasonable confidence is placed in it or immodest claims made for it. Our theories would often serve us better than they do, if we could estimate them for what they are: not finalities, but theories, working hypotheses, points of view, means of insight, etc. It is a very poor one indeed that is not of some service; it is a most excellent one indeed that does not soon run us into errors, extravagances, and dangers, if we push its application.

The way in which Professor Pfleiderer applied this theory to the various religions would seem to indicate, whether he intended it or not, that he regarded religion as a projected morality. Observe especially the remarks about the cultured Greek, Roman, and Chinaman. To do this would be to limit it in actual fact to morality, when we undeceive ourselves as to the source of the projected objects of worship and of our relationships. Our only excuse for longer letting our moral conceptions take such objectified form would be, that it added a greater glow of enthusiasm and romance to our actual moral relations to think them in such a manner, or that it were best for the common folk to have this sort of supernatural outlook.

Again the chief or pivotal terms of the division, freedom and dependence, are not used throughout in the same sense, as will be seen by a thoughtful examination. At the start they are the fundamental elements of all pious feeling, but later it would seem that one or the other had, in his mind (especially the sense of freedom), become the all-absorbing, all-worthy element. On this, witness his discrimination regarding the Persian religion, where the

sense of dependence is indicated as though belonging to the character of mind which debases itself before demons.

The position in the plan to which he assigns both Buddhism and Islam are entirely wrong in my opinion. The prominent characteristics of the former place it under freedom, those of the latter assign it to the side of dependence.

Another remark should be passed, viz., that we would be led by this theory to place too high an estimate on average Christianity; since, except in the very highest cases, has there neither in Christianity, Judaism, or Mohammedanism ever been more than a practical adjustment or compromise between these two fundamental elements. Such a consummation were devoutly to be wished, and such a classification or analysis would have inestimable value if its calling attention to these relations aided in any way so practical an end. One can scarcely doubt that here is an attempted expression of one of the deepest features and relations of the religious life, and though its full and satisfactory explanation may yet be unaccomplished, we become convinced that it has in it a profound reality.

D. CLASSIFICATIONS BASED ON RACIAL RELATIONSHIP. GENEALOGICAL.

1. *According to Linguistic Affinity.*

Prof. Max Müller (*Introd. to the Science of Religion*, p. 143 ff.) says: "The only scientific and truly genetic classification of religions is the same as the classification of languages. Particularly in the early history of the human intellect, there exists the most intimate relationship between language, religion, and nationality." The outward appearance, tangibility, or framework of religion in early times, that by which it was communicable from heart to heart, centered around a few words and expressions pertaining to deity, sacrifice, altar, prayer, possibly body,

soul, virtue, sin. "Early religion and early language are most intimately connected, religion depending entirely for its outward expression on the more or less adequate resources of language." To understand this clearly, is to arrive at a basis for the most useful classification of religions. Whatever genetic relationships exist between languages "ought to hold together the religions of the world, at least the most ancient religions."

In Asia, with its most important peninsula Europe, we have three families of languages: Turanian, Semitic, and Aryan. In each of these (especially the first two) the growth of language became arrested, i. e., ceased to be natural, and through religious and political influences became permanent and solidified. With this petrifaction of language into historical speech went on a like petrifaction of religion into the three great independent settlements. The character of the latter is in great measure determined by that of the former, or at least is found to be of similar analogy.

Of *Turanian* languages, Chinese is the oldest representative. If we look into its early forms we get light on this early family of religions. Accompanying the prosy speech of China we find an ancient colorless and unpoetical religion, one which might, after the manner of the language, also be called monosyllabic. Its deities are a host of independent spirits, having in the worshiper's mind little mutual interrelationship. They are evidently personifications of the heavens, sun, storms, mountains, rivers, etc. Beside these stands the worship of ancestral spirits and those of the more recently departed who are believed to be lookers-on of human affairs and to be exercising their powers for good or evil. This old form of faith, a double worship of human and natural spirits, lives on even yet among the lower ranks, though at least since the time of

Confucius it has been superseded in the upper stratum of intelligence.

Among *Semitic* races the names of deities clearly mark off their religions as characteristic, though indeed in language, literature, and general civilization they are so different from each other and from themselves at different times. Yet running through the polytheisms of Babylon, Phoenicia, and Carthage, as well as the monotheisms of Jews, Christians, and Mohammedans, there runs the same great dominant characteristic notion of *God in History,* God mingling in and ruling over the affairs of men as individuals, races, and nations, as contrasted with the characteristic of God in nature. The tendency of the peoples has been to lay the stress of life on social organization and moral relationships; hence as we might expect, Semitic deities in general bear names expressive of moral qualities: the Strong, the Exalted, the Lord, the King, etc. Generally, too, the anthropomorphism is not strong nor the dramatic activity prominent. Hence their tendency to monotheism, aided by the external circumstance of monotonous desert life.

And thirdly the *Aryans,* though now scattered by extended enterprise to all parts of the globe, are a family easily recognized by the roots of their language. Through the names of their gods also they show an original oneness of religion. Professor Müller denies the oft-repeated remark that their worship may be characterized as a worship of nature, and says, "if it had to be characterized by one word, I should venture to call it a worship of *God in Nature,* of God as appearing behind the gorgeous veil of Nature, rather than as hidden behind the veil of the sanctuary of the human heart. The gods of the Aryans assume an individuality so strongly marked and permanent, that with the Aryans a transition to monotheism required a

powerful struggle, and seldom took effect without iconoclastic revolutions or philosophical despair."

* * *

Here are three types of religion accompanying three types of language and race, the formation and settlement of which into these special features have and will for all future time determine the fate of the whole human race. The three unities which at some remote past epoch these peoples formed, have in course of time through increase of numbers and other circumstances disintegrated into what might seem a chaos of peoples, tongues, and religions. Yet it was not a chaos, for out of this seemingly inextricable confusion of dialects and variety of races our modern science has been able to assert the original unity and restore the principal former characteristics. (As yet the case with regard to the Turanians is somewhat doubtful.)

Professor Müller makes reference to an African and an American family of races, languages, and religions which long ago broke up into various divisions without developing literature or settled speech, and hence their relationships are a vastly more difficult study. At the time in which he was speaking there was little to be gained from them in the way of support for his general view.

* * *

The case of *Aryan unity* he develops at some length giving substantially the same reasons that I have done in another place relying principally on the authority of Pictet. (See "The Primeval Aryans, etc.") He cites the names of their principal deities, calls attention to their terms expressive of the most essential elements of religion, as prayer, sacrifice, altar, spirit, law, faith, etc. He also mentions such cases as the terms for house, town, king, etc.

The comparison of the *Semitic family* of languages is carried out with more completeness. Here the relation is closer, the sub-races have never been so scattered, their intercourse has been more frequent, and hence their linguistic and religious relationships are more manifest. So manifest indeed is the former, that no Semitic scholar has ever thought it to be worth his while to carry out such a comparative study of their likenesses as Pictet and others have done within the Aryan family. Nor has there ever been wrought out a comparative grammar of the Semitic languages, like that of Bopp's, e. g., on the Aryan. By the same process of comparison which has been so successfully carried on in the Aryan group could we here still easier reconstruct the primeval Semitic civilization and religion. (A noble work yet to be executed by some earnest progressive-minded Semitic scholar who might tell us how this race lived and what they believed and thought before Hebrew was Hebrew, and before there was any Syriac, Aramaic, Arabic, Ethiopic, Phoenician, or Babylonian speeches.)

The evidence of the pre-historic oneness of the Semites drawn from the names of the deities is unusually strong. This similarity of appellation and its meaning points to the fact that there must have been a time when they as well as the Aryans decided as one people upon certain names for their gods, and nothing is more evident than the fact that this period preceded the special development into the separate languages and individual religions. The root *El* (meaning Strong) tells a great history with regard to this race. In Babylonian inscriptions we find it in *Ilu* (God), as well as in *Bab-il* (the gate or temple of Il). Among the Hebrews we have it in *Beth-el* (house of God), and in *ha-El,* preceded by the article (the Strong, the God, i. e., Jehovah). The Phoenicians in Byblus (Jebel) worshiped *El,* the son of Heaven and earth. His grand-

father *Elium*, the most high God, was killed by wild animals, and his father dethroned, and finally slain by himself. Philo identifies this god El with the Greek Kronos, and represents him as the presiding deity of the planet Saturn. This same El is the presiding deity of this planet according to Diodorus Siculus. And the Himyritic inscriptions in Southern Arabia also contain it. The Hebrew *Eloah* (plural *Elohîm*) is the same word as the Arabic *Ilâh* (God), which without the article means god in general, and with the article, *Al-ilâh* or Allâh, it is the God of the Koran. Again it appears in the Arabic in the feminine *Allât* to whom a famous temple at Tâïf was dedicated; and this Allât of the Koran (whose temple was destroyed by Mohammed's command) is doubtless the one mentioned by Herodotus (iii, 8).

The word *Baal* or *Bel* is another name of deity common to most of the Semitic peoples. Assyrians, Babylonians, Phoenicians, Carthaginians, Moabites, Philistines, and Jews all worshiped this deity as a great or as the supreme God. This points to their earlier unity as a race and to his greatness as a god. Later through local worship we hear of many Baals (Baalîm collectively and with special names singly): *Baal-tsur* (of Tyre), *Baal-tsidon* (of Sidon), *Baal-tars* (of Tarsus), *Baal-berith* (of Shechem, god of treaties, Judg. viii. 33; ix. 4), *Baal-zebub* (of the Philistines at Ekron, 2 Kings i. 2, 3, 16), *Baal-peor* (of the Moabites and Jews, Numb. xxv), and *Baal-Shâmayîm* (on Phoenician coins). The last named is the Beelsamên which Philo speaks of as the Phoenician sun-god, thus: "When the heat became oppressive the ancient races of Phoenicia lifted their hands heavenward to the sun. For him they considered the only God, the lord of heaven, calling him Beelsamên, which with the Phoenicians is lord of heaven, and with the Greeks Zeus."

The *Ashtoreth* mentioned in the Old Testament and

worshiped by the Jews (1 Kings xi. 5; Judg. iii. 12), the *Ishtar* of the Babylonians mentioned in inscriptions and in the famous epic (Geo. Smith, *Chaldean Account of Genesis*), the *Ashtar* of the Moabite stone, and the *Astarte* of the Syrians, are one and the same goddess. Traces of this goddess and her consort are also found in the Himyaritic kingdom, as in *Athtar*.

The Hebrew *Melech*; the *Moloch* of Carthage, Crete, Rhodes, and the valley of Hinnom; the *Milcom* of the Ammonites (who had a sanctuary in Mt. Olivet); and the *Adrammelech* and *Anammelech* of the Sepharvites (to whom, according to 2 Kings xvii. 31, they burned their children in sacrifice), are local varieties of an early Semitic deity.

The Old Testament *Adonâi* (my lord) applied only to Jehovah, was in Phoenicia the very name of the Supreme Deity. This personage, as is well known, was adopted into the Greek mythology, and became transformed into the beautiful young Adonis, loved by Aphrodite, and killed by the wild boar of Ares.

Yet other names are mentioned besides these. Altogether the case is an unusually strong one from this class of words alone, that the Semitic religions belonged together geneologically as a class on the same basis that their language in other ways relate them as peoples of the same race. The period when they were one people with one language and one religion far antedates historic times, yet, as in the case of the Aryans, it is none the less certain; and should the work be undertaken by a scholar competent for the task, I doubt not that a much better reconstruction of primeval Semitic civilization and religion might be effected than has been done in the former case.

On the *Turanian* ground the way is less sure. The subject is exceedingly difficult, because it has been comparatively little investigated. The languages of the Chi-

nese, Mandshus, Northern Mongolian, Tartars, Finns, etc. have as yet been very little a subject of scientific study. However, with such evidence as may be obtained, the matter of proving a linguistic relationship as a basis for a relationship of religions is attempted. Müller's method of proof is faulty here in that he calls to his aid the similarity in the religions which he would, as proposed at first, prove by linguistic relations alone. Nevertheless the case is not so badly blemished as to make the investigation worthless, since they do actually assist each other much. In the cases of the Aryans and Semites we knew more of their languages at start than we did of their religions, and hence our knowledge of the former very naturally proved a great help toward a better understanding of the latter besides showing their geneological connections. But with the Turanians, we are better acquainted at the outset with their religious notions than with the family relationship of their tongues. Hence very naturally the racial unity which the similarity of their religions points to is aided but not absolutely proved by the investigation of the leading religious terms. In the background of all Turanian religions are certain fundamental ideas which have a closer resemblance even at first glance than any of these have with other faiths. With all of them there goes a nature worship of a sort peculiar to the group. A few comparisons and terms will show what basis there is for the attempt.

In the Shu-king (one of the most ancient sacred books of China) *heaven* and *earth* are the father and mother of all things. In the ancient poetry, *Heaven* alone is both father and mother. The heaven-spirit is called *Tien,* and is ever used as the name of the supreme deity, i. e., he is the Chinese Jupiter or Allah. The word means the Great One, and in Chinese characters is compounded of two signs: 大 (*ta*) meaning "great" and 一 (*yih*) meaning

"one," 天 (*ta-yih* or *Tien*). The Peerless, the Great, the High, the Exalted, the One, stands above all else. It is personified as the ancestor of all things, as the framer, as having decrees and will, as sending sages to teach the people, as knowing men's hearts, and as comforting them. This was the solace of Confucius when he desponded because men would not hear him: "Heaven knows me." With the other multitude of nature spirits believed in by the common people, the sages had little to do. "Respect the gods, and keep them at a distance," was a remark of Confucius when pressed by his disciples regarding the bearing of a wise man toward them. These gods were spirits of the sun, moon, stars, earth, mountains, rivers, and ancestors of the people.

Putting beside these facts the less complete and probably less trustworthy accounts of travelers from Central and Northern Asia, we recognize some striking coincidences. "Everywhere we find a worship of the spirits of nature, of the spirits of the departed, though behind and above it there rises the belief in some higher power, known by different names, sometimes called the Father, the Old One, who is the Maker and Protector of the world, and who always resides in heaven." From Chinese historians we learn that the Huns worshiped the sun, moon, spirits of the sky and earth, and spirits of the departed. Menander, a Byzantine writer, relates of the Turks in his time, that they worshiped fire, water, earth, and believed in and sacrificed to a god whom they regarded as the maker of the world. Castrén, the chief modern authority on the religion of these Northern Mongolians (See his *Vorlesungen über finnische Mythologie*), says of the Tungusic tribes: "They worship the sun, the moon, the stars, the earth, fire, the spirits of forests, rivers, and certain sacred localities; they worship even images and fetishes, but with all this they retain a faith in a supreme being which they

call *Buga.*" " The Samoyedes," he says, "worship idols and various natural objects; but they always profess a belief in a higher divine power which they call *Num.*" This deity they also call *Juma,* which is the same as the *Jumala* of Finland. *Jumala,* from *Juma,* thunder, and *la,* the place, meant originally the sky. Later it signified the god of the sky, and finally came to designate gods in general. Among Lapps, Esthonians, Syrjanes, Tcheremissians, and Votyakes the same word is found with slight dialectic variations having the like chief signification. Castrén tells a good story to illustrate Samoyede sun worship, or heaven worship where the sun is thought of as the heaven god. He asked an old woman whether she ever said her prayers. She replied: "Every morning I step out of my tent and bow before the sun, and say, 'When thou risest, I, too, rise from my bed.' And every evening I say, 'When thou sinkest down, I, too, sink down to rest.' " And she added with a touch of self-righteousness: "There *are* wild people who never say their morning and evening prayers."

So much for the general similarity of religions; but are there no linguistic connections? We saw that the Chinese *Tien* meant sky, god of the sky, and god in general, being in meaning the exact counterpart of the North-Turanian *Jumala.* In Mongolian speech we find *Teng-ri* with the same three meanings, with the later signification of spirit or demon, good or bad. In Turkish we have *Tangry* or *Teñri,* and in Yakute *Tangara.* Earlier Chinese authors tell us that the Huns gave to their leaders the title *Tangli-Kutu* (or in Chinese *Tchen-jü*), which meant in Hunnish speech Son of Heaven. Now this title Son of Heaven, *Tien-tze,* is also the Chinese designation of their emperor. Again, the Chinese historians say that the Tukiu, the ancestors of the Turks, worshiped the spirits of the earth, calling them the *Pu-teng-i-li.* If, as is probable, *pu* means

earth, we have in *teng-i-li* the Mongolian *teng-ri*, used in that early time as the general name of gods and spirits.

In this series then we have a piece of linguistic evidence of considerable value. We perceive for those of the family in closest connection a name derived from a common root given to the highest deity, and afterwards passing through like organic changes in the process of development. "Everywhere they begin with the meaning of sky, they rise to the meaning of God, and they sink down again to the meaning of gods and spirits." These changes of meaning in the words run parallel with the changes which took place in the religions of these peoples.

We have now seen the basis on which Professor Müller would set up a science of religion. The linguistic evidence for a classification of the religions of peoples dwelling in Africa, America, and Polynesia is not taken up in this work. The three groups most conspicuous in history are examined and the case is thought strong enough to draw the induction, that in linguistic relationships we have the ground for the most useful divisions within the field of religion. Leaving aside the incompleteness of the examination both as to the number of groups left out and the unsatisfactoriness of the result, especially in the case of the Turanians, the questions should be raised: Most useful for what purpose? and why exclude other classifications for other purposes? As I have again and again remarked, each division which proceeds to look at the subject from a new point of view adds its contribution toward a complete understanding, and consequently is just as legitimate and indispensible as any other. Whoever then in an attempt to be scientific makes a new ground of division should endeavor not to commit that grossest of unscientific deeds, viz., the exclusion of facts within his field, even though those facts come in the form of classifications which he did not originate and over which he consequently does not glow

so earnestly. It has not been established by anything Professor Müller has brought forward, nor do I know of any reason why it should be assumed, that "scientific" and "genetic" cover each other, as he seems to assume at the outset. Like all the views before studied, this has its peculiar place. This sort of starting-point for the study of religions puts us on track of racial and historic connections and relationships between them. It affords help toward answering one of the greatest demands of our times, viz., the question as to the origin and development of things, i. e., the "genesis" question. In this respect it is indeed a welcome suggestion. Yet we must not be so blind in our enthusiasm as to suppose the questions over which we and our age are chiefly interested constitutes the scope of "scientific" investigation. Through language it is possible to study mythologies and religions as in no other way. Their organic relationship can be shown ofttimes beyond a doubt, and then by the aid of history their relative claims of originality and independence can be reasonably settled. In this way unjustifiable assumptions may be set aside and credit be placed where it belongs. It consequently incites to progress by driving us beyond these old assumptions, since it shows us their origin, their relation to other similar ones, their process of development, and, if we will, will help to point out a higher standing-ground for the future. Whatever can assist toward such desiderata has need of no other excuse for its presence.

II. According to Ethnological Relationships and Historical Connections.

A NEW CLASSIFICATION.

The reason for an ethnological classification of religions is the fact that religion gets its character from the people or race who develop it or who adopt it, and that the re-

ligions of related peoples are more nearly alike in character. I have already quoted Max Müller's remark that "particularly in the early history of the human intellect, there exists the most intimate relationship between language, religion and nationality." As history advances the lines do not run quite so closely parallel. Each and all become intermixed and influenced from without; yet the cast imparted to it and the type which its exponents give it are ever manifest. (Compare, e. g., English, Spanish, and Russian Christianity.) However, notwithstanding all the deviations or separations between race and religion, there yet remains a striking unanimity. This is presented to us at a glance when we take the trouble to compare an ethnographic and a religious map of the world. We have in our time, however, to compare groups or families of each instead of individuals or single members as would be the case in a study of the conditions in ancient times.

Within the last few years we have heard much about universal religions as contrasted with national or race religions; but how strictly in the mass of the populations the racial lines are maintained and how thoroughly they modify any importations of foreign faiths brought about by military might or political influence, is most manifest as soon as our attention is given to the situation. To take an illustration or two from the best known cases: the Christianity of the Romish type, although preached with an unrivalled pertinacity, has signally failed to take a deep hold upon the Teutonic, or Germanic, races. It has been able to take root only where the Roman civilization had been or was at the same time planted. The independent spirit of Northern Europe was never subjected to the Roman yoke, and as soon as it reached a sufficient degree of culture, it produced its Wiclifs, Husses, and Luthers who, with the material then at hand, developed a distinct

racial religious tendency. And the tenacity with which these lines yet hold is too well known to need a word of comment or support. Just as Romanism has found it impossible to penetrate northward, so Protestantism has made little impression on Southern Europe. Wherever Romance peoples are (in Italy, France, Spain, Portugal, Mexico, and South America), there is Roman Christianity in the ascendency; wherever Teutonic, or Germanic, peoples are (in Germany—excepting the southern part where the population is less purely German, and where it was more subjected to Roman civilization—Scandinavia, Great Britain, Iceland, United States, British America, and Australia) there is Protestantism.

Now the same influences, forces, and isolated circumstances which developed a special race developed at the same time a special religion, which is a necessary constituent element or part of a race (at least after man had reached a certain stage of mental power or growth). Or, as above explained, if the religion be one imposed upon the race from without, it is destined to be made over and modified to correspond with the peculiar character, notions, and circumstances of the people who come to adopt it. Only an occasional thinker rises above the peculiarity which makes his people a distinct one and advocates more universal tendencies; and since the influence of these rare-coming individuals must be for various reasons exceedingly limited (especially because the broader views which they preach, in negating so much of the old peculiarities, seem to the masses irreligious), the stamp given to a religion must ever come in greater part from the side of the mediocrity of the population. Only at rare intervals in history does there come a juncture of conditions when individual influence can rise so high as to overturn the popular views; and then we have the beginning of what later is called a new religion. The new views are grad-

ually taken up by the masses and gradually but certainly wrought over, interpreted and developed to correspond to the tendencies and environments of the race in question. Now it should be evident that a religion is not sufficiently understood (whatever else we may know about it) until it is seen in reference to these racial peculiarities and circumstances of life. And if religion cannot be studied in its fulness and fairness without going into its ethnical manifestations, not more can we expect without such a treatment to obtain a due appreciation for this great historic factor. An ethnological study of the field will have the advantage of showing what has been contributed by the various races to the full idea or concept of religion. It will show us that its essence has been conceived to consist in now one and now another element, and through this will teach the elements which properly belong within its domain. In this way, its investigation will do away with a multitude of misconceptions and onesided ideas.

Believing then, as I do, that new light may be thrown upon religious phenomena by undertaking its examination in such a manner as above suggested, and believing, as I have said elsewhere, that such a study is demanded by the broad candid requirements of our genuine modern science; I offer the accompanying ethnographical divisions and outline tables as a guide for such an examination. Although we are far from possessing the material for a complete understanding of all these peoples, yet more is at hand than most of us are aware of, more perhaps than we yet have capacity to use, and more, it is to be feared, than we yet have disposition to use with fairness and impartiality toward those belonging to other stems of the race. In support of this remark about the material which stands ready for scientific disposal, as well as for the general correspondence of the arrangements here adopted with the facts, I beg leave to call attention to the works of Tylor,

Spencer, Fr. Müller, Peschel, Ratzel, Hartmann, and Waitz, and to the multitude of works referred to by these well-known writers.

A TENTATIVE ETHNOGRAPHICO-HISTORICAL CLASSIFICATION OF THE HUMAN RACES TO FACILITATE THE STUDY OF RELIGIONS.—IN FIVE DIVISIONS.

TABLE I.

OCEANIC RACES.

- Malayans
  - Malacca
  - Sumatra
  - Java
  - Borneo
  - Madagascar
- East Malayans
  - Formosa
  - Phillipine
  - Celebes
  - Molucca
- Micronesians
  - Pelew
  - Caroline
  - Marshall
  - Gilbert
- Melanesians
  - Solomon
  - Fiji
  - New Caledonia
  - New Hebrides
  - New Guinea
  - Tasmania
- Polynesians
  - Tonga
  - Samoa
  - Society
  - Marquaesas
  - Paumotu
  - Hawai
- Australians
- Maori (New Zealanders).

TABLE II.

See *Völker-Karte* in Ratzel's Völkerkunde, Bd. I, 20.

AFRICAN RACES.

- Negroes: Peoples of the Soudan region etc.
- Bantus: Kafir and Kongo Peoples of Central Africa.
- Quoi-Quoin: Hottentots and Bushmen.

For North Africans, see Table V.

TABLE III.

AMERICAN RACES.

1. Eskimo. (The connecting link with Mongolian.)
2. North American Indians. (Including many tribes from British America to the Gulf of Mexico.)
3. Nahuas (Including the Aztecs, Toltecs, and Nahuas extending from Vancouver's Island to Nicaragua.)
4. Antilleans. (Including the Mayas in Yucatan and the Natchez between the Red and Mississippi Rivers. Were one of the most gifted of American peoples. Subjected by the Caribs.)
5. Muyscas or Chidchas. (In South America.)
6. Quichua, Aymara, etc. (Culminating in the sun worship of the Incas of Peru. A natural growth to a very high stage.)
7. Caribs and Arowaks. (Along the whole north coast of South America.)
8. South American Indians
   - Brazillian.....
     - Tupi-guaranos
     - Indios Mansos
   - Southern and South-east Tribes.....
     - Abipones
     - Pampas Indians
     - Puelches
     - Pategonians (or Tehuelches).
     - Fuegians.

TABLE IV.

MONGOLIAN RACES.

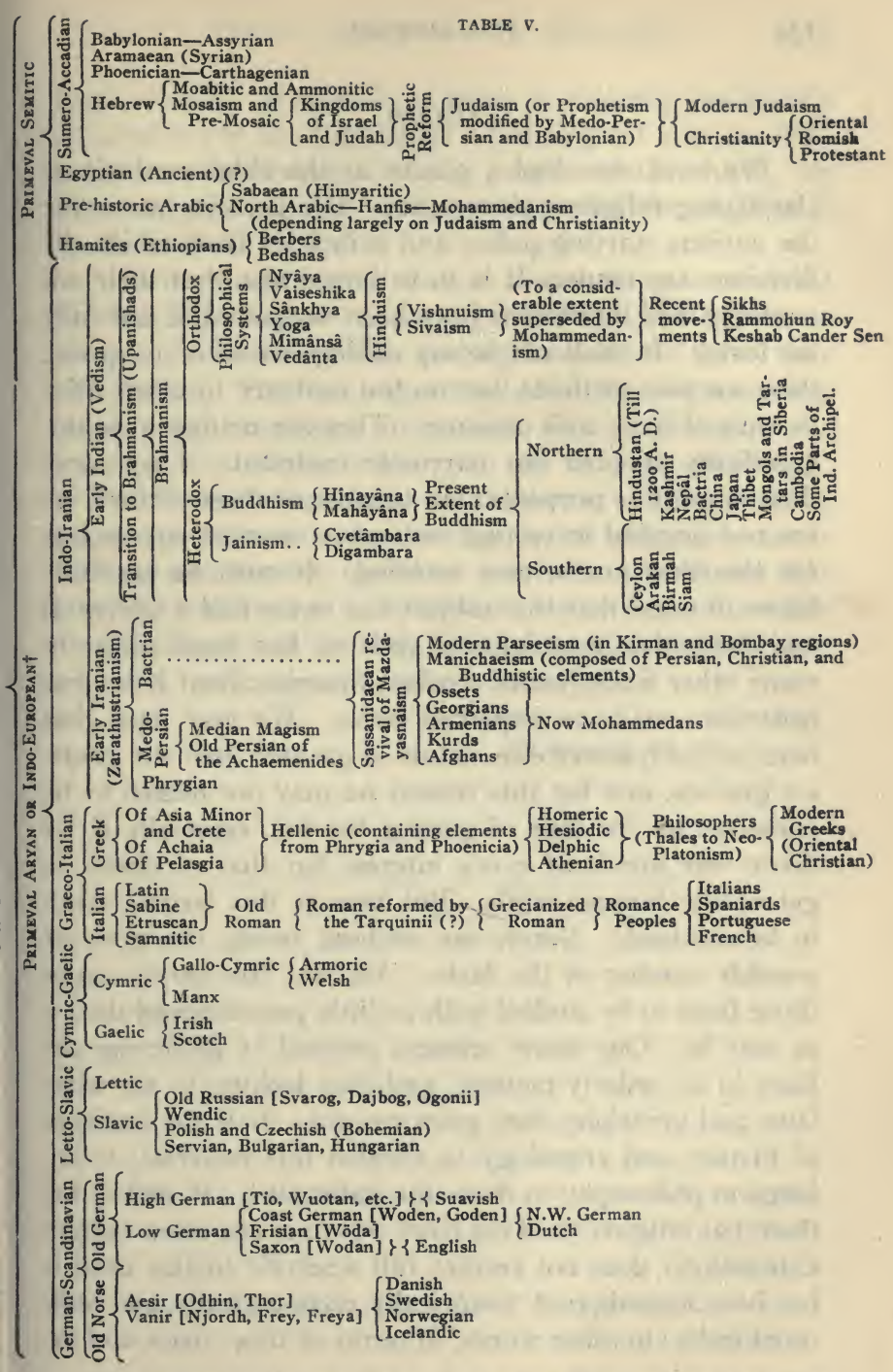
Mongol-Tartars of Northern and North-Eastern Asia.

Ural-Altaic
(original unity of this branch has been proved by *Castren*, the highest authority on it.)
- Lapps
- Esthonians
- Finns
- Magyar
- Turkish
- Tibetan

Indo-Chinese
- Burmese
- Siamese
- Chinese (ancient national religion)
  - Confucianism
  - Taoism
  - Chinese Buddhism

Japanese
(Old national religion Kami-no-madsu or Sin-to.)
- Confucianism (Introd. from China in 7th cent.)
- Buddhism (Introd. from Corea about 552)

TABLE V.



* This title was given by Oscar Peschel. It is not very fitting, but answers as well as any other proposed. Gerland uses "Indo-European." Blumenbach called these peoples "Caucasian."

† On the subdivisions of this family see the discussion of "The Primeval Aryans."

FINALE.

We have now had a glance at the chief methods of classifying religious phenomena. We perceive moreover the various starting-points and principles from which the divisions are made. It is to be hoped also that their advantages and limitations have been suggested, if not fully set forth. It shall not be my calling hereafter to ignore these various methods, but on the contrary to often refer to some of them with pleasure. They are neither to be unqualifiedly adopted nor narrowly excluded. They serve their respective purposes; but because of these virtues, we are not justified in resting content as soon as our desires for clearness are in part satisfied. It must be carefully borne in mind that this subject has never had a universal and impartial investigation such as has been given to many other fields; hence the best theories about it are but inductions made on imperfect bases. We may trust that here, as everywhere else, nature is greater than our greatest guesses, and for this reason we may not hasten to tie ourselves up for fear of getting too far, especially if we divest our minds of every interest but that of desire to get at the largest truth. But how is this largest truth to be attained? Surely not without seeing the greatest possible number of the facts. And not less surely ought those facts to be studied with as little perconceived theory as may be. Our better sciences proceed by gathering the facts in an orderly manner, and then looking to see what laws and principles they point toward. It is the business of history and ethnology to furnish this material; it belongs to philosophy to draw the inductions. It strikes me then that religion (and not more this than any other human expression) does not receive full scientific justice until it has been investigated, historically, ethnologically, and philosophically; in other words, in terms of time, space and in-

most essence. Inasmuch as there is virtually no history obtainable (in the continuous chronological and developmental sense) for most of the peoples of the world, the historical and ethnical study must go for the most part hand in hand.

The first requisite for such an undertaking is to obtain through ethnological science a general notion of the races of men and of the various leading branches of these, past and present. This has been attempted in the five preceding tables, and the reasons for it have been given in former pages of this treatise and in the one on "Introduction to a Historico-Ethnical Study of Religions." Those leading races now form so many leading points of inquiry under each of which many questions are to be asked; and first from the multitude of answers returned may be undertaken the building up of the body or superstructure of what we may fitly term a genuine science of religion.

DUREN J. H. WARD.

CRITICISMS AND DISCUSSIONS.

A GERMAN CRITIC OF PRAGMATISM.

Ludwig Stein of Berne, editor of the *Archiv für systematische Philosophie,* publishes a criticism of pragmatism in a recent number of his periodical (XIV, Part II). His summary of the history of the word will be interesting both to pragmatists and to people in general who are interested in pragmatism, for he points out that pragmatism is not even "a new name for some old ways of thinking, but that both the pragmatic method and the name in its most modern sense are ancient." He says (pp. 143-5):

"The expressions *pragma*[1] and *pragmateia*[2] occur in Plato's dialogue Cratylos, but especially in the logical writings of Aristotle (see the Aristotelian Index of Bonitz) as frequently as they are rare in post-Aristotelian, particularly in the pre-Socratic, philosophy. The meaning of the word *pragma* varies between 'thing,' 'object' and 'reality'....

"According to Aristotle the linguistic phonetic symbol[3] bears the same relation to the concept[4] as the name[5] bears to the object.[6] In this case the word *pragma* means the concrete individual object. Aristotle shows perfectly the distinction between figures and phonetic symbols (De soph. elench., cap. I, p. 165a, 7). He says that we can never cognize things (*pragma*), but we only utilize names as symbols of things. Therefore we erroneously confuse the name and the thing it stands for in that when performing calculations as in the cypher code we substitute the name for the thing. In the logic of Aristotle the object, *pragma,* plays an important rôle in opposition to the name *onoma.* The Aristotelian Index of Bonitz enumerates dozens of passages under the catch-words *pragma, pragmateia,* and *pragmateuesthai.*[7] Once even the expression *pragmatologein*[8] ap-

[1] πρᾶγμα. [2] πραγματεία. [3] σημεῖον. [4] νόημα
[5] ὄνομα. [6] πρᾶγμα.
[7] πραγματεύεσθαι. [8] πραγματολογεῖν.

pears (1439 β 20). The opposition between *pragma* and *onoma* seems to have been familiar in Socratic circles presumably even as early as in the time of the Sophists.....

"However, with Aristotle we find the expression *pragma* used also in the very same meaning which Peirce and James assign to the word to-day. Aristotle sometimes understands by it the real empirical fact in opposition to that which is merely thought, that is to say, pure thought-entities (*entia rationis*). In his logical writings and in the Metaphysics Aristotle distinguishes repeatedly between the ideal[9] and the real."[10]

On page 148 Professor Stein criticises James's etymology of the term *praxis*[11] as "at least one-sided." He goes on to say:

"This is the definition given by the greatest leader of the Stoics, Chrysippus, according to Laertius Diogenes (VII, 94): good is that which is morally useful, and evil is that which is morally harmful. The question of the *telos*[12] is the central point of their ethics. Every good, we read, (*loc. cit.* VII, 98) is profitable.[13] We call that profitable which is of use to us.[14] Since Aristotle had made the statement that in nature there is nothing useless and nothing happens in vain,[15] the Stoics caricature this utilitarian principle to the point of absolute folly. In Chrysippus utility degenerates to a farce. According to Cicero (*De Natura Deorum* II, 13, 37), everything exists in the world only for the sake of the gods and man: the horse for riding, the ox for plowing, the dog for hunting and watching. The gradation of creatures is equally utilitarian with a view toward the benefit of the human race which comprises the center of the universe, as the human community itself is derived and founded for purely utilitarian ends (Cicero, *De Finibus,* III, 20, 67). And so accordingly the real founder of pragmatism, Peirce, refers to the connection of his ideas with those of the Stoics.

"In Baldwin's *Dictionary of Philosophy and Psychology,* II, 323, under the catch-word "Pragmatism" the originators of the term, Peirce and James, give their position. Etymologically the following derivation is given: 'Pragmatism (Gr. *pragmatikos,*[16] versed in affairs).' This derivation as shown above is historically untenable. Only *pragma* and *pragmateia* are customary terms, not *pragmatikos.* Then, too, *pragma* in Plato and Aristotle never means 'versed in affairs,' that is to say, versatile, skillful, intelligent, ex-

[9] διϰνοίᾳ. [10] πράγμασι. [11] πρᾶξις.
[12] τέλος. [13] συμφέρον. [14] ὠφέλιμον. [15] μάτην.
[16] πραγματιϰός.

perienced; but first of all it means an object or thing in opposition to a name or phonetic symbol. In post-Aristotelian philosophy indeed the expression *pragma* or *pragmateia* disappears from use. In the *Doxographi Graeci* of H. Diels this expression occurs in only half a dozen passages in all. The later the word *pragma* is used the more the emphasis is laid upon the practical meaning which has been pushed to the foreground by Peirce and James, and in general the post-Aristotelian philosophy shifts the center of gravity from theory to practice, from logic and physics to ethics. The good is no longer referred to the true but the true is referred to the good. And this is the kernel of the pragmatism of Peirce and James.

"*Consequences* are the decisive epistemological viewpoint of Peirce and James. Exactly as we have recognized an ethics of consequence ever since the first utilitarians, the Cyrenaics or hedonists, that is to say, the ethics of utility, later so called by Bentham and Mill, there lies in pragmatism an attempt to formulate a logic of consequence. Let James's definition be placed side by side with that above given by Peirce (Peirce has repeated his definition in Baldwin's *Dictionary* s. v. 'Pragmatism'). Pragmatism is, according to James, 'the doctrine that the whole "meaning" of the conception expresses itself in *practical consequences*' (the italics are mine), consequences either in the shape of conduct to be recommended or in that of experience to be expected, if the conception is true.....

"The expression 'pragmatic' had a historical sound long before Peirce used it. The 'pragmatic sanction' of Charles VI established the Austrian succession according to the requirements of utility in the interest of principles which served the public welfare, and even in German usage an intelligent foresighted and able person is called a pragmatic fellow (*ein pragmatischer Kopf*) without any evil secondary meaning. Moreover, the 'pragmatic method' has been naturalized in historiography much longer than Peirce and James imagine. The 'Text Book of the Historical Method' by Ernst Bernheim devotes an entire section to the instructive pragmatic method of history (*Lehrbuch der historischen Methode,* p. 17 ff.). Bernheim defines the essence of pragmatic historiography as follows: 'At this stage matter does not appear desirable for its own sake alone, but on account of definite practical applications; man must learn something for practical purposes from events of the past.' The first conclusive representative of the pragmatic standpoint is Thucydides. Polybius introduced the term 'pragmatic his-

tory'[17] (Hist. I, cap. 2). The mistakes of the pragmatic method of historiography are subjectivity and a tendency against objectivity. And these also are the reefs along which the philosophical pragmatism of a James or Schiller must steer carefully, as we will show later....

"Where Peirce has picked up the word 'pragmatism,' whether in Kant or in Aristotle, he himself is not aware. The expression apparently was in the air. Peirce himself informs us[18] that thirty years previously in his above mentioned publication he had set in motion the subject although not the word of pragmatism. He had only used this expression in oral conversation until James, who was not acquainted with him when he wrote *The Will to Believe,* had appropriated it and put his stamp upon it as a philosophical term. In my book *Leibniz und Spinoza* (Berlin, Reimer, 1890) I have made the statement that Leibnitz had the same experience with his term 'monad.' It is true he met occasionally with the term in Plato, but it was not until his intercourse with the younger van Helmont at the court of Queen Sophia Charlotte, that he definitely appropriated and set in circulation this term whose meaning had been heightened by van Helmont. However, not only did Peirce happen upon the expression 'pragmatism' as a designation of his theory of activity but simultaneously, although quite independently, it was coined by the French thinker Maurice Blondel, the advocate of a 'philosophy of action.' André Lalande in his treatise 'Pragmatism and Pragmaticism' (*Revue Philosophique,* 1906, p. 123) relates how Blondel had answered his question about the discovery of the term pragmatism as follows: 'I proposed the name of pragmatism to myself in the year 1888, and I am conscious of having invented it as I never before had met with the term, etc.' In his work 'Action' he analysed the difference between *praxis, pragma* and *poiesis,*[19] and decided upon the expression pragmatism at a time when Peirce had used it only in oral discourse. This duplication of the incident is not surprising, especially since this designation was made obvious by the pragmatic historiography then in vogue. Yet as early as the year 1867 Conrad Herrmann wrote a 'History of Philosophy Treated Pragmatically.'[20] In this Herrmann expresses his opinion on the

[17] πραγματικὴ ἱστορία

[18] "What Pragmatism Is," *Monist,* April, 1905.

[19] ποίησις.

[20] *Geschichte der Philosophie in pragmatischer Behandlung.* Leipsic, Fleischer.

subject of the pragmatic method in the science of the history of philosophy, that the impression of the pragmatic seemed to him the most suitable for his style of historical representation (Preface, p. vii): 'The expression of the pragmatic indicates in and for itself only the simple real or properly actual in things, and it apparently coincides with the concept of a merely narrative or purely empirical presentation of history' (*loc. cit.*, p. viii). In this connection Herrmann sets himself in conscious opposition to the speculative method of Hegel (p. 463 ff.): 'Pragmatism is the only true scientific principle for the treatment of historical material. The essense of all historical pragmatism is to eliminate chance from history and to place in its stead causative necessity. The pragmatic method should have the individual data to combine in a whole system. Pragmatic historiography should not work with principles but with facts.' In a special essay 'The Pragmatic Sequence in the History of Philosophy,' Conrad Herrmann had previously laid down his program according to which all historical pragmatism 'should have a definite practical point.' Exactly this 'practical point' James has evidently adopted. He did not need to give a 'new name' to 'old methods,' especially the methods which arose under Thucydides and those theorists among the sophists who advocated the right of might, but the name itself has had a historical ring since the time of Polybius and a philosophical ring ever since Plato and Aristotle."

According to Stein the trend of pragmatism is a teleological view of the world in contrast to the aeteological view of science now commonly accepted by naturalists. Says Stein (p. 156):

"The kernel of the pragmatic method consists in referring the logical to the teleological. Every method of classifying a thing, says James (*The Will to Believe*, p. 76) is only a method of applying it to some particular purpose. Concepts and classes are teleological instruments."

Professor Stein says on page 146, that pragmatism is practically neither more nor less than a theory of truth. It proposes a new criterion of truth which gives life and color to this philosophical movement that is spreading with lightning speed. He says:

"This criterion of truth which is found in pragmatism—the utility of cognition, its suitability, its efficiency or power to work—C. S. Peirce himself has formulated clearly and tersely in a later essay ('What Pragmatism Is,' *Monist*, April 1905, p. 171): 'Consider what effects that might conceivably have practical bearings you conceive the object of your conception to have; then your con-

ception of those effects is the whole of your conception of the object.' Some years earlier Georg Simmel, whom James indeed claims as a typical pragmatist (with incomparably greater right moreover than R. Eucken whose theory of activity follows Fichte much more closely than Mills and Spencer) in the first volume of the *Archiv für systematische Philosophie* (1895) found a much terser wording without even knowing the name pragmatism or having in mind this tendency which even then lay potentially in embryo. The treatise, *Ueber eine Beziehung der Selektionstheorie zur Erkenntnistheorie,* concludes with the following words which might be placed as a motto for pragmatism: 'The utility of cognition produces at the same time the objects of cognition' (p. 45).

"Simmel sees in the utility of cognition the primary factor which matures certain methods of procedure so that 'originally cognition was not first called true and then useful, but first useful and afterwards true.' This criterion of truth by its tendency towards an act of selection receives from Simmel that biological bent which has prevailed since the appearance in the field of Avenarius and Mach. The thought is itself essentially Leibnitzian. Leibnitz concedes true existence only to that which works (*quod agit*). In England and America this criterion of truth has been given the epithet 'instrumental' in contrast to 'normative.'"

The tendency is in the air, but Professor James has made himself the standard bearer of the movement. Stein says:

"At first pragmatists sailed under various flags. Those who were of an especially logical turn, originally called themselves 'intentional' or 'instrumental.' James was called a 'radical empiricist' before he brought forward the word in the year 1898 in a lecture before Professor Howison's philosophical union at the University of California, and made a special application of it to religion. (Cf. *Pragmatism,* p. 47). F. C. S. Schiller was called 'humanist' before he joined James and adopted the designation pragmatism for his world-conception. And so summing up we can well say that the same struggle which took place in the last decade in Germany between psychologists and logicians—the polemical pamphlet of Melchior Palágyi gives the best account of the situation—on the other side of the water takes the form of a skirmish between pragmatists and spiritualists or idealists, *pur sang.* Protagoras is the model of the one party (Schiller professes to follow Protagoras as perhaps also Laas and Mach), Plato that of the other. A new wine in old bottles. The sentimentalism of the pragmatism of

James comes from Protagoras, but on the other hand he owes both method and expression to Aristotle."

Whether Professor Stein is right in regarding pragmatism as opposed to "spiritualism or idealism *pur sang*" is rather doubtful, for we must remember that Professor James himself and many of his adherents have vigorously defended some of the most disputed facts of spiritualistic seances. It is well known that Professor James still believes in the genuineness of occult phenomena and communications from the dead to the living.

Pragmatism is a strange compound of many contradictory conceptions and it is probable that Professor Stein systematizes it more than the pragmatists themselves would approve. Pragmatism is in a word sentimentalism, that is to say, it places all reality in sentiment. This is done also by Mach in so far as Mach deems sensations to be the ultimate realities. Yet for all that, James draws other conclusions and incorporates in his conception of sentiment many things which Mach would cut out as illusions. There is an unmistakable kinship between Schopenhauer, Nietzsche and James as pointed out by Professor Stein. He says:

"The kernel of the whole matter is the supremacy of the will, practical reason as Kant would say, over thought. Therefore James also is a much stricter voluntarist or activist than, say, Wundt; he approaches more nearly the theory of the supremacy of feeling over understanding as it was prevalent in the English sentimentalist philosophy of the eighteenth century, and is to-day in the psychological school of Th. Ribot in France and in the 'world-conception theory' of H. Gomperz in Vienna. The voluntarism of Schopenhauer receives in James as well as in Ribot the Hamann-Jacobi tendency which Goethe once expressed in the terse formula 'sentiment is everything' (*Gefühl ist alles*). Quite without justification James leads a passionate polemic against Herbert Spencer in whom he sees his opposite pole with relation to the theory of cognition, while Spencer in his latest works teaches entirely and without reserve supremacy of feeling as much as James and Ribot. Whoever reads Spencer's treatise 'Feelings versus Intellect' in his last work *Facts and Comments* (1902) will find the following sentences which appear literally in Duns Scotus, but which are no less decisive than those of James: 'The chief component of mind is feeling' (p. 25)....'emotions are the masters and intellect the servant' (p. 30). That is the James-Ribot form of the voluntarism of Schopenhauer....

"The voluntarist James should take one step farther and enlist himself in the ranks of the great voluntarists and energeticists from the Scotists to Fichte's 'being springs from doing,' and Nietzsche's 'will for power.' In reality the question in pragmatism is nothing else than a consistent development of the supremacy of practical reason not in a sense of a Kant-Platonizing concept-realism but in the style of that innate nominalism which has pervaded England since Duns Scotus, Roger Bacon and William Occam. For already with these English nominalists, as is the case to-day with James, an extreme voluntarism was combined with the supremacy of the practical reason, an epistemological nominalism with an ethical individualism."

Professor James who often has his fling at Kant may be surprised to find that there is a great probability that the word pragmatism is directly derived from Kant. It is interesting to read what Professor Stein has to say:

"Kant is perhaps the innocent cause that the name pragmatism has been taken up and has been made the small coin of daily philosophical intercourse. In this connection I am thinking less about the title of Kant's anthropology which Kant himself labeled 'pragmatically considered' (*in pragmatischer Hinsicht*), but on Kant's preface to this work in which the pragmatic is opposed to the physiological: 'The physiological knowledge of man rests upon the investigation of what nature makes of man; the pragmatic, on that which as a free agent he makes of himself or can and should make of himself.' So according to Kant all rules of intelligence, for instance, are pragmatic (*Grundlegung zur Metaphysik der Sitten,* p. 42, Rosenkranz ed.). Everything practical which serves human welfare he calls pragmatic. 'The practical principle derived from the hankering after happiness I call pragmatic' (*Kritik der reinen Vernunft,* p. 611). Hence according to Kant, pragmatism would be a rule of prudence or a utilitarian demand of merely accidental persuasive power. The distinctive mark of the useful and the universally valid is derived from pragmatic cognition. It is only a belief, not knowledge (*Kritik der reinen Vernunft,* p. 623). And indeed the question is not of a necessary but of an accidental belief. 'I call such accidental beliefs which however lie at the bottom of the actual employment of the means to certain actions, pragmatic beliefs' (*Kritik der reinen Vernunft,* p. 628). Thus we may see that according to Kant a pragmatic conception of truth such as James

and Schiller have to-day established, represents pretty well the first step to the knowledge of truth.....

"The utilitarian is the undertone of the pragmatic, and exactly this pragmatic utilitarian *sous entendu* is as great a discord to the ear of the German idealist of Königsberg as it is sweet harmony flattering the ear of the 'smart' American. For Kant utility is a counter-argument to absolute moral worth, hence the pragmatically useful method of observation or treatment is only of value in orientating, as a card catalogue or alphabetical arrangement is to the librarian, for these are always better as rules of wisdom than absolute disorder. But such a pragmatic arrangement is in the most favorable instance an artificial, even though ever so useful, classification of the schools, but not a classification made by nature. The distinction between pragmatic classification and the accuracy of the classification according to nature is according to Kant a fundamental one (*Werke,* VI, 315); the classification of the schools has only one purpose, namely to bring created things under their proper title, the classification according to nature endeavors instead to bring them under laws."

Professor Stein's tendency to systematize appears in the following comment. He says:

"Heinrich von Stein in his 'Seven Books on the History of Platonism' has produced the convincing proof that philosophical thought has vibrated back and forth in constant rhythm for two thousand years between Plato and Aristotle. This is true as well of the twentieth century as of its predecessors. Half a century ago Trendelenburg brought Aristotle again to our knowledge. The neo-Kantianism under the leadership of Cohen on the other hand helped Plato to victory. Just now Aristotle is again on top by the roundabout way via Leibnitz. Those thinkers who are interested in biological considerations are to-day grouping themselves again around Aristotle just as those who tend in a mathematically logical direction cluster around Plato. In Germany this dissension appears under the slogans, Psychologism against Logism, Vitalism against Mechanicalism, and Positivism against Idealism. In America and England it has coined the formula, Pragmatism against Transcendentalism. *Tout comme chez nous.* The French maxim: *plus que ça change, plus c'est la même chose* is true of philosophical controversies, schools, party designations, and catch words."

Professor Stein appears to go too far in characterizing the different philosophers as either Platonists or Aristotelians. It is true

that there is a contrast between a recognition of the facts upon which our world-conception is based and the theories which furnish the system of its construction. But if he would carefully compare Plato and Aristotle he would find (as has been pointed out from time to time) that Aristotle is a Platonist and Plato is an Aristotelian. Though Aristotle has his fling at the Platonic ideas he practically adopts the theory that there are eternal types, and though Plato is an idealist who believes in the eternal ideas as the modes of things, he does not deny that the phenomenal world is the actual world of sense; and the contrast in which these two systems have frequently been placed is a contrast merely produced by more or less of emphasis laid upon two opposed (not contradictory) principles, and the different systems in the history of philosophy are exactly characterized by the way in which they combine the contrast and recognize the truth of these principles. It is true, however, that Professor James carries the principle of pragmatism to such an extreme as to almost entirely obliterate the principle of systematic thought, theory, logic, rationality, etc. Professor James is a romanticizing philosopher in contrast to such stern and strict classical thinkers as Kant and his school. Says Stein: "The type of thought directly opposed to this logistic classicism is sentimental romanticism. As the former longs for the peace of the conclusive answer the latter seeks the eternal activity of restless questioning;" and further down on page 172: "Pragmatism gathers together all those tendencies of our age with its fevered philosophical excitement which carry on a common war against the thing-in-itself, against all metaphysics, against transcendentalism, idealism, in short against that Platonizing Kantism which is most conspicuously represented and most appreciatively supported by the Marburg school (Cohen and Natorp), under the names Natural Philosophy, Energetics, Psychologism, Positivism, Phenomenalism, Friesian Empiricism, and Relativism."

Here the onesidedness of Professor Stein's classification appears most pronounced. From the point of view of my own philosophy I would be at a loss in what manner to dispose of it. I am decidedly opposed to the subjectivism of Professor James, I most emphatically uphold the objective significance of truth, and yet I reject the idea of the thing-in-itself and all metaphysics based upon it. My solution of the problem[21] briefly stated runs thus: There are

[21] For details see my criticism of Kant in my little book *Kant's Prolegomena*; and also my exposition of the problem in my *Surd of Metaphysics* in the chapter "Are There Things-in-Themselves?"

not things-in-themselves but there are forms-in-themselves. Professor Stein declares:

"For many years together with certain ones of my pupils I have defended the thesis that Kant did not refute Hume. In my book "The Social Optimism" (*Der soziale Optimismus,* Jena, Costenoble, 1905) I demonstrate that Hume is not a skeptic but the leader of positivism and that Kant has not refuted him in any point. The case is not yet at an end."

I have not seen Professor Stein's exposition of his views on Kant and Hume, but I am inclined to believe that I would agree with him. However, I trust that in the books referred to I have pointed out the weak point of Kant's position; but on the basis of the Kantian conception of the contrast between matter and form, the *a posteriori* and the *a priori,* sensation and pure *Anschauung* with all that it involves, I hope to have answered Hume's question and thus laid a foundation for a system in which the old contrasts will find a just reconciliation. Here are some paragraphs of Professor Stein's critique of pragmatism:

"A criticism of pragmatism must proceed from the inside outward; that is, from its own hypotheses, and not from the standpoint of idealism, as Münsterberg attempts. There are two different temperaments as James has rightly said, but temperaments are not to be opposed. 'As I see it' now stands as the inscription before every temple, not only the pantheon of art but also the severe cathedral of science. To see in one's own way can never be criticised. The question is only whether a man has seen rightly from his own standpoint, and right here is the starting-point of our own objection to pragmatism....

"In place of the two criteria of truth represented by Plato (Aristotle too) and Kant, namely necessity and universal validity, we have here the hedonistic utilitarian criteria of truth, individual utility and general practicability. The true and the good agree with each other; this is the demand of the biologic-teleological foundation of logic as pragmatism states it. In addition, it is true, to earlier tendencies of thought, but still with a strongly emphasized personal note.

"Against this biological logic a series of considerations arise in the meantime even under the foundation of the pragmatic point of departure wherefore I expressly affirm that I will neither repeat the arguments which Husserl in his fundamental 'Logical Investigations' and Münsterberg in his 'Philosophy of Values' (*Philosophie der*

Werte, Leipsic, Barth, 1908) have arranged in imposing conclusiveness against all psychologism. I do not propose to refer here to even the purely polemical literature of the English, French and Italians against pragmatism.[22] It is much more important for me to consider the difficulties of thought which in spite of my sympathetic position towards the fundamental demands of pragmatism I can not suppress. If Messrs. James and Schiller will take the trouble to look through my 'The End of the Century' (*Wende des Jahrhunderts,* Tübingen, Mohr, 1899), 'The Sense of Existence' (*Der Sinn des Daseins, ibid.,* 1904) and 'The Social Optimism' (*Der soziale Optimismus,* Jena, Costenoble, 1905), they will discover now and again almost verbal correspondences in that which I call evolutionary criticism and the optimism of energetics. In case James and Schiller would attempt to claim me as well as Wilhelm Jerusalem in the ranks of pragmatism, I shall have to point out my opinions against methods and results....

"Pragmatism with its genetic theory of truth is only new in that it discloses itself as logical evolution. Truth is placed in the stream of practical development. As once the followers of the Heraclitean Cratylos, the teacher of Plato to whom he had dedicated his dialogue of the same name, are jokingly called the 'flowing ones,'[23] pragmatists recognize only one developing truth which will gradually approach the absolute truth or its ideal heights."

Professor Stein takes the underlying principles of pragmatism and systematizes them—in spite of Professor James. The latter may not take the consequences but Professor Stein seems to argue that if pragmatism were consistent Professor James ought to hold the views to be derived from its maxims. We doubt very much whether Professor James would be prepared to regard the ego as " a mere practical unit for a preliminary provisional consideration" (p. 182). Stein says:

"Mach's definition of the ego as unity of purpose and James's theory of concepts or classes as teleological instruments, arise from the common fundamental conviction that all spiritual life is teleological. The teleological unity of the ego according to Mach rests upon an unanalysed constant. The ego is accordingly a practical unit for a preliminary provisional consideration. The same is the case with concepts of substance, being, doing, matter, spirit. They

[22] Among the last G. Vailati is of a special importance. See "De quelques caractères du mouvement philosophique contemporain en Italie," *Revue de mois,* 1907.

[23] οἱ ῥέοντες, i. e., those that are in a constant flux.

are abbreviated symbols for the purpose of an easier orientation in the surrounding world. All science thus shrinks into one impression as all deduction according to Mill is only an abbreviation and inverted induction, a memorandum for thought.

"Here we have the *proton pseudos*[24] as well of pragmatism as of Hume's positivism and all related tendencies. Quite apart from the fact that the biological method which James and his school would apply to logic is already shattered on the fact that biology itself is still to-day in the condition of fermentation and insecurity and accordingly possesses no suitability for a foundation of the most certain of all sciences, formal logic, pragmatism takes the same course which Hume was not able to escape. Hume refers substance and causality to habits of thought and laws of association; but how have laws of association found entrance into the human brain? Why have all men and animals the same laws of association by contiguity or innate similarity? Hume concludes the validity of the laws of association *by means of* the laws of association already in effect....

"It is quite clear, however, that pragmatism too has it *a priori*, that is the *telos*, and if we jest about the logism of Kant, that in spite of us man comes into the world with a completed table of categories so let us not forget to consider the beam in our own eye. We are all *a priori* sinners. Or, does it matter so much if man comes into the world according to Kant with a table of categories, according to Hume with completed laws of association, according to Avenarius and Mach with an automatically functioning economy of thought, and finally according to James and Schiller with an apparatus of utility and selection like an innate scale of values? Let us first of all be honest with ourselves. Pragmatism accomplishes nothing but to set up a teleology of consciousness in the place of a mechanics of consciousness such as Hobbes, Spinoza, Hartley, Priestley, Hume, the naturalists, materialists, and psychologists of association have offered us."

EDITOR.

A STUDY IN ABNORMAL PSYCHOLOGY.

Ever since Professor Ribot published his book on *The Diseases of Personality* people interested in psychology have been aware of the importance of the remarkable cases enumerated in the book. Among them the most interesting and perhaps the most instructive

[24] πρῶτον ψεῦδος.

group is that relating the phenomenon of double personality which by later observations has had to be amplified into multiple personality, a remarkable disease that throws much light upon the nature of personality. Dr. Morton Prince has written a book[1] rich in material on the subject, and we might at the start repeat the author's statement that a more correct term of the disease would be "disintegrated personality," for each secondary personality is a part only of a normal whole self.

The bulk of the book is filled with observations of the case of a patient whom he calls Miss Beauchamp, a name that is pronounced "Beecham" and has been adopted for the purpose of disguising the identity of the subject. It is not the patient's name but one which at the start of the disease was taken up by one of her secondary personalities, invented to distinguish herself from the others. Dr. Morton Prince uses it to denote the whole personality which during the course of the disease is broken up into four, briefly alluded to as "B I," "B II," "B III," and "B IV."

The expositions of the case continue the line of work started by Professor Ribot, and Sidis and Goodhart; they prove that the theory of Professor Ribot is correct, and the cases he has collected are here paralleled, though the material here presented is fuller, richer and more detailed than that of Dr. Prince's French predecessor. This does not say that Ribot's valuable book is antiquated. On the contrary, Ribot's *Diseases of Personality*[2] remains classical for the very reason that it is brief and contains in a narrow compass the main outlines of the basis upon which stand his American successors Boris Sidis and Morton Prince. The book of Sidis and Goodhart[3] is more complete and treats the subject with great thoroughness, entering also into a discussion of dream life, the dual life, mental resurrection, infant personality, etc.

The reviewer has discussed the problem of double personality in his *Soul of Man*,[4] pp. 258 ff.; he there calls attention to the dream-ego which sometimes forms a personality quite unlike the normal character in the waking condition. A secondary personality however, is more stable then the personality of the fleeting dream.

The book before us is in its main bulk a biographical study of

[1] *The Dissociation of a Personality. A Biographical Study in Abnormal Psychology.* By Morton Prince, M.D. London: Longmans Green, 1908.

[2] Chicago: The Open Court Publishing Co.

[3] *Multiple Personality*; New York: Apleton, 1905.

[4] Chicago: The Open Court Publishing Co.

a most instructive case. It is impossible to enter into details, but we will say that the patient, Miss Beauchamp, possesses a remarkable amount of information regarding her infirmity, and thus she is in many respects well fitted for a subject of psychological observation. Dr. Prince begins his cure by hypnotizing his patient, and finally succeeds in curing her.

Dr. Prince describes the conditions of the case on page 23:

"The whole history of the Beauchanmp 'family' has been like that of a person who has been exposed to an almost daily series of railroad accidents or nervous shocks. Owing primarily to a natural, and secondarily to a still greater acquired, instability of nervous organization, the *contre-temps* of ordinary life have acted like a series of mild shocks, resulting in little traumatic neuroses. The immediate effects have been removed from time to time by suggestion; but the original fundamental instability, magnified a hundredfold by the psychological disintegration which was brought about by a mental accident of recent date, has made possible a frequent repetition of such shocks. Most instructive is the fact that with the complete synthesis of all the personalities into one, with the reintegration of the shattered mental organization, stability becomes re-established and the physical health becomes normal."

Dr. Prince attempted to cure Miss Beauchamp through suggestion in a hypnotic state and the personality of "B II" was from the start simply Miss Beauchamp asleep. But soon the strange phenomenon was observed that the hypnotized subject spoke of herself either as "I" or as "she," and this occurred at distinct periods. When the patient used the pronoun "she," she did not remember her own sayings which she had uttered in the state when she spoke in the first person. Dr. Prince says:

"The hypnotic self, then, let it be borne in mind, is distinctly the same personality as Miss Beauchamp awake. She speaks of herself as the same person, making no distinction whatsoever, except that she is now 'asleep,' or what 'you call asleep.' On the other hand, when awake, as already stated in the introduction, she has no knowledge or remembrance of herself in the hypnotic state. On awaking there is complete oblivion of everything said and done in hypnosis. There is also a large degree of passiveness in the hypnotic self. She sits with her eyes closed (never having been allowed to open them), and though she converses, and even sometimes argues and defends her own views, she tends to passiveness. like most subjects in hypnosis.

"Up to this time the only personality with which I was acquainted, and the only one known to her friends, was the Miss Beauchamp whom I have just described as B I. But there now appeared upon the scene a new character, who was destined to play the leading rôle in the family drama that was enacted during a period of six years. This character at first appeared to be a second hypnotic state, but later proved a veritable personality, with an individuality that was fascinatingly interesting to watch; she largely determined

the dramatic situations, and consequently the health, happiness, and fortunes of Miss Beauchamp. She became known successively as B III, Chris, and finally as Sally, according as acquaintance with her grew."

Dr. Prince was careful to avoid influencing any one of these several personalities by his own suggestions. He experimented again and again. But, says he:

"Repeated experiences made it plain that Miss Beauchamp when hypnotized fell into one or the other of two distinct mental states, or selves, whose relations to the primary waking consciousness, as well as their memories, were strikingly different. From the very first they claimed different relations with the waking Miss Beauchamp."

The condition of the patient during her disease of multiple personality is briefly summarized as follows:

"She may change her personality from time to time, often from hour to hour, and with each change her character becomes transformed and her memories altered. In addition to the real, original or normal self, the self that was born and which she was intended by nature to be, she may be any one of three different persons. I say three different, because, although making use of the same body, each, nevertheless, has a distinctly different character; a difference manifested by different trains of thought, by different views, beliefs, ideals, and temperament, and by different acquisitions, tastes, habits, experiences, and memories. Each varies in these respects from the other two, and from the original Miss Beauchamp. Two of these personalities have no knowledge of each other or of the third, excepting such information as may be obtained by inference or second hand, so that in the memory of each of these two there are blanks which correspond to the times when the others are in the flesh. Of a sudden one or the other wakes up to find herself, she knows not where, and ignorant of what she has said or done a moment before. Only one of the three has knowledge of the lives of the others, and this one presents such a bizarre character, so far removed from the others in individuality, that the transformation from one of the other personalities to herself is one of the most striking and dramatic features of the case. The personalities come and go in kaleidoscopic succession, many changes often being made in the course of twenty-four hours. And so it happens that Miss Beauchamp, if I may use the name to designate several distinct people, at one moments says and does and plans and arranges something to which a short time before she most strongly objected, indulges tastes which a moment before would have been abhorrent to her ideals, and undoes or destroys what she had just laboriously planned and arranged.

"Aside from the psychological interest of the phenomena, the social complications and embarrasments resulting from this inconvenient mode of living would furnish a multitude of plots for the dramatist or sensational novelist. Considered simply as a biography, therefore, an account of Miss Beauchamp's later life could scarcely fail to interest, if it were told divested of the details which are necessary for the purpose of scientific study."

A disintegration of the normal personality into several secondary personalities does not, or need not, mean a serious disturbance of other mental functions, for says Dr. Prince:

"Disintegration as thus used must not be confused with the same term sometimes employed in the sense of degeneration, meaning a destroyed mind or organically diseased brain. Degeneration implies destruction of normal psychical processes, and may be equivalent to insanity; whereas the disintegration resulting in multiple personality is only a functional dissociation of that complex organization which constitutes a normal self. The elementary psychical processes, in themselves normal, are capable of being reassociated into a normal whole."

Dr. Morton Prince's book contains, however, many more interesting phenomena which are worth our while to know and investigate. The most important of them, so it seems to us, is a phenomenon of great significance in the line of religious experience which has been characterized by psychologists, among them Prof. William James, as "sudden conversion." The patient under Dr. Morton Prince's care, Miss Beauchamp, though not of a specially religious nature, experienced a state quite analogous to the transformation in religious experience which after a sudden crisis endows a person with a new conception of the world. After a period of unsettled thought the patient changes for good and assumes a stable character, well balanced, and we might almost say cured. All doubts have gone, and what has been prepared during the crisis is suddenly organized into a state of comparatively great stability. Difficulties are removed, problems settled and peace is attained. In describing such a change in Miss Beauchamp Dr. Prince distinguishes between the intellectual and emotional attitudes; the pictures of the many scenes which she saw, the places in which she found herself during the period of hallucination, the friends with whom she conversed, the visions she had of Christ and the saints, the music she heard, from the several states of emotion, of peacefulness, of rest, of exaltation, of lightness of body, of mental relief, of joyousness, etc. The emotional states continued as if indicating that they were the stable elements in her mental condition while the intellectual features of it that found expression in concrete pictures, scenes or words, including voices which she heard, were of a more fleeting nature. Dr. Prince describes her state as follows:

"After a short time Miss Beauchamp awoke, and on waking all the memories which made up the consciousness of the hypnotic state were forgotten. At first her mind was a blank so far as logical ideas were concerned. She

thought of nothing definite, though soon ideas rapidly flitted through her mind, and yet she was filled with emotions. They were the same emotions which belonged to the different memories of the hypnotic state. These emotions persisted. They were of lightness of body, of physical restfulness, and well-being, besides those of exaltation, joyousness, and peace, largely of a religious nature. It is probable, reasoning from analogous phenomena that I have witnessed, there were subconsciously present a number of disconnected images, or memories, —remnants of those which had been experienced in the trance state, and associated with the emotions. Presently ideas began to come into her mind. The emotions were now accompanied by a lot of ideas and memories of religious experiences. It is significant that these ideas were not those originally associated with the emotions in hypnosis, but newly suggested ideas. At least they appear to have been suggested by the emotions. She felt well and believed herself cured at last."

The case of Miss Beauchamp bears many striking similarities to kindred occurrences enumerated by Prof. William James in his *Varieties of Religious Experience.*

These observations on sudden conversion are supplemented by Dr. Prince in the appendix to the second edition which contains a very remarkable case of a new patient of his. The case being of great interest we here reprint the whole account:

"I am enabled to add another case which I had an opportunity to subject to psycho-analysis almost immediately after the crisis. Although it is not of the religious type, it is the same in principle, being a conversion from the attitude of doubts, dissatisfaction, bitterness, and rebellion against life to one of peace, contentment, and faith. The fact that the same phenomena are observed where the conversion is not of religious faith is of importance in connection with the spiritualistic interpretation; for manifestly if we find the same phenomena where religion is not a factor, but where the psychological conditions are identical, the phenomena may be referred to a common principle, viz., psychological laws.

"The subject was at once particularly favorable both for the development of the phenomena in question and for a psycho-analytical investigation. She is a cultivated, intellectual person, who is interested in psychological problems and contributes her co-operation to their solution. She can be easily hypnotized and several states obtained, each with a different range of memory. The time of the episode was the anniversary of her husband's death, which had happened three years previously, and in consequence of which she had gone through much mental anguish, more than ordinarily belongs to such sorrow, owing to certain indirect consequences which the necessity of concealing the identity of the subject forbids my referring to. This fact, however, has a direct bearing on the phenomenon. As the anniversary approached, the painful memories began to occupy her mind; and during the two preceding weeks she was tormented by doubts, pain, and distress. Harassing dreams, not remembered, however, after waking, had produced physical pain in the form of headache and prostration. These had been recovered from before the episode occurred. When the day was near, she determined to fight against the dis-

tressing memories and the old ideas of dissatisfaction with life, the feelings of injury, bitterness, and rebellion against fate, and the 'kicking against the pricks' which these memories evoked. For a long time she had tried to accept the new situation and the new ethical point of view, but with only temporary success. With great effort she heroically put all these ideas out of her mind and did not allow herself to think of them. She supposed she had done so successfully.

"My first intimation of what occurred was contained in the following letter, which, it should be noted, was written an hour after the occurrence, while the facts were vivid in her mind:

"'It is one o'clock in the morning, but I feel I must write you of the strange thing which has just happened to me. To-day, or rather yesterday, was the day of my husband's death. I kept myself very busy all day and would not allow myself to think, but when I came to my room at night I could no longer repress the memories against which I have steeled myself for more than a week. It came upon me like a flood—all that I had lost—all that I could never have again—memories of happy days and bitter ones. I did grieve, I did feel all the old remorse, the old self-reproach, the bitter rebellion and anguish of heart. I could not help it, Dr. Prince—there was no one to speak to and I fought against it as long as I could. Mr. —— died just before midnight, and as that hour approached I was kneeling by my bed—not to pray—my heart was too bitter for that—I don't know why I was kneeling—but all at once I saw my husband before me, perfectly plain and distinct but not ill and worn as I remember him. He looked well, strong, happy. He stood on the other side of the bed from me and seemed surrounded by a luminous vapor, and his whole appearance was of brightness. As I looked he spoke—the words ring in my ears now. He said: "If I were still ruled by earthly emotion nothing could make me so unhappy as to see you as you are now. As when I was with you I wished you to be happy so I wish you to be happy now. Remember me or forget me—it makes no difference in the end—love never dies. Think no more sad or gloomy thoughts, fill your life with every pleasure; by so doing you make possible to me a higher, fuller life."

"'A feeling of peace, so deep, so enthralling, came upon me. I felt his love about me like an atmosphere—it was almost palpable—I rested in it. I did not move, and the vision faded. I was not asleep, Dr. Prince. I did not lose consciousness. I am somewhat unnerved now. I hardly know what to think. Several explanations suggest themselves to me at once. I had eaten very little—I was somewhat exhausted by several hours of grief. The words represent thoughts I have sometimes had myself; they may also be suggestions you have given me in hypnosis, they may be something I have read—I don't know; but it has made a deep impression on me, and though I am no believer in spiritism I cannot help but feel that at least with him "all is well." The past is gone, the present is mine, and I will, with your help, try to use it wisely. This is Tuesday morning, 1.15, —— 1908.

"Here was a chance, not to be lost, to investigate the psychological conditions underlying the hallucinations and the after effects. So, at the first opportunity, a psycho-analysis was undertaken. Then conditions to be determined were: First, the conscious content of the subject's mind preceding the hallucinations; second, the character of the mental state at the time of their

occurrence; third, what, if any, co-conscious states existed previous to, during, and after the hallucinations; fourth, the character of the mental complexes succeeding the episode. Taking the last first, it is sufficient to say that the subject was in an unusually happy and peaceful state of mind, in kind that described in the last sentence but one of the letter. She was not, however, in a state of ecstasy or undue elation, but rather in a normal, peaceful mood such as one would attain who had lost previously distressing doubts, memories, and perverted points of view and now had attained a new and more healthy conception of life and her relation to it. The emotional tone was that of joyousness and happiness, which stood in marked contrast with the mental tone which, for the most part, as I have observed it, has dominated her conscious life. Physically and mentally she seemed unusually well. She could not give any further explanation of the development of the hallucinations beyond what she had written. She remembered nothing more that threw light upon the incident. It proved afterwards, however, that there was a gap in her memory.

"The psycho-analysis was made in three different hypnotic states, the memories of which, as with Miss Beauchamp, were not coextensive. The general result may thus be summarized: While the subject was on her knees, her glance fell upon a photograph of her husband. From the glass covering this a bright electric light was reflected directly into her eyes. She went into a light hypnotic condition in which she had the hallucination. After coming out of this light trance there was no amnesia for it excepting for the perception of the photograph which she did not consciously recognize, but the visual hallucination came at the moment when her eyes met the photograph.

"The conditions were more complex, however, than this. During the two weeks preceding the crisis, as a result of the stress and strain through which she was passing, there developed a condition of light disintegration. The thoughts which she believed she had put out of her mind continued to a greater or less degree as a stream of subconscious thought. She was not aware of this stream, although from time to time it arose into her consciousness only to be put out again. Besides this there were all sorts of co-conscious memories of the past in the form of visual pictures, similar to what has been described in the Beauchamp case. Just before she had the hallucination there was present a co-conscious visual picture of her husband. This undoubtedly co-operated with the co-conscious perception of the photograph to produce the visual hallucination. The words spoken by the voice were a reproduction in substance of words spoken to her about two months previously by a friend who tried to reconcile her with the conditions of her life. This she had forgotten in the sense that she had not recalled it or connected it with the episode. The experience was voluntarily recalled by only one of the dissociated states which offered it as explanation of the hallucinatory words. The other two and the subject herself recognized the identity of the sentiments and probable origin when asked if this friend had ever spoken of the matter to her. The hallucinatory words were, therefore, a conscious automatism arising from the *un*conscious.

"Succeeding the crisis there also developed co-conscious pictures which affected her consciously and tended to strengthen the new faith in the conditions as they existed, and the new attitude of mind."

A LETTER FROM PROFESSOR JAMES.

Among the philosophers of to-day there is scarcely any more interesting figure than that of Prof. William James of Harvard; and his philosophy, which, adopting an expression of Mr. Chas. S. Peirce, he calls pragmatism, is as broadly before the public as any system of thought. Our readers will therefore be glad to find in the present number an article by Prof. Edwin Tausch on "The Great Pragmatist," which is written in a sympathetic tone, and Professor James himself has perused this psychological analysis of his mental makeup. He gives expression to his sentiments on the subject in these words:

"I have read with great relish your diagnosis of my case.... I am astounded at the knowledge you show of my *ipsissima verba*, and it gives me a queer feeling to be treated so philologically. I find your account of my evolution instructive, though I am hardly able to criticize it as one might who knew me from without. I can't tell about utilitarianism—I didn't come to it unaided, but was taught it by Chauncey Wright, whose anti-religious teaching, however, I reacted against. I think you overdo my personal mysticism. It has always seemed to me rather a matter of fair play to the various kinds of experience to let mystical ecstacy have its voice counted with the rest. As far as I am personally concerned it is the ordinary sense of life that every working moment brings, that makes me contemptuous of rationalistic attempts to substitute thin logical formulas for it. My *flux*-philosophy may well have to do with my extremely impatient temperament. I am a motor, need change, and get very quickly bored.

"I say nothing of your general plan of tracing beliefs to temperamental needs. I believe it is in essence quite sound, though hard to rescue from the appearance of superficiality. In sum, I have found the essay extraordinarily competent and interesting."

I will add that we owe the opportunity of publishing Professor Tausch's analysis of "the great pragmatist" to Professor James himself, who advised the author that his article might be a welcome contribution to *The Monist*, and we wish to express our indebtedness for this suggestion to Professor James publicly. We take it as an evidence that our critical review of pragmatism has not been amiss but is received in the spirit in which it was written.

EDITOR.

BOOK REVIEWS AND NOTES.

PHILOSOPHY. By *Nicholas Murray Butler.*
MATHEMATICS. By *Cassius Jackson Keyser.* New York: Columbia University Press, 1908.

We have received two pamphlets of the Columbia University series of lectures on science, philosophy and art which are now in progress of publication. The one entitled "Philosophy" by President Butler is a survey of the present situation in the philosophical world which contains valuable suggestions and illuminating flashes of light. We quote the following sentences verbatim:

"To grasp in fullest significance the movement of contemporary thought, and to pass judgment upon it with some approach to a proper sense of proportion, the student must know his Kant. Max Müller's phrase was a good one: 'Kant's language is the *lingua franca* of modern philosophy.' It is not too much to say that without an understanding of Kant the door to a just appreciation of modern thought is closed.....

"It is said of Kant that he used to tell his students at Königsberg that he sought to teach them, not philosophy, but how to think philosophically. This view of the teaching of philosophy, which I hold to be the correct one, is the reason why students of philosophy, particularly beginners, should concern themselves with the works of the genuine masters of philosophic thinking, and not waste their time and dissipate their energies upon the quasi-philosophical and the frivolously-philosophical writing, chiefly modern and largely contemporary, which may be not inappropriately described as involving Great Journeys to the Homes of Little Thoughts!

"The clever intellectual posing and attitudinizing of Nietzsche, whose body and mind alike were sorely stricken with illness, is only a travesty upon philosophy. The curiously barren efforts of Haeckel, when he leaves the field of science in which he is an adept, are but little better. Even the form of philosophy called Pragmatism, for which the great names of Oxford, Harvard and Columbia are academic sponsors, and which when unfolded to the man in the street leads him to howl with delight because he at last understands things, should come late and not early in a student's philosophical reading. A background of considerable philosophical knowledge will aid in giving it a just appreciation. There are critics who have the fear that Pragmatism, in its attempt to be both profound and popular, may, forgetful of the ancient warning of Plautus, suffer from attempting to blow and to swallow at the same time."

The essay on mathematics, written by Professor Keyser, may fitly be called a rhapsody on mathematics. To our mind Professor Keyser's scorn of applied mathematics in contrast to popular mathematics is exaggerated. It seems to us that applied mathematics is the best explanation of the seriousness and the paramount significance of mathematical truth. At the same time we do not venture to criticize Professor Keyser for his admiration of pure mathematics which looms like a lofty peak into the heavens while its roots are buried in earthly soil. We were especially pleased with the following passage:

"Phrase it as you will, there is a world that is peopled with ideas, ensembles, propositions, relations, and implications, in endless variety and multiplicity, in structure ranging from the very simple to the endlessly intricate and complicate. That world is not the product but the object, not the creature but the quarry of thought, the entities composing it—propositions, for example,—being no more identical with thinking them than wine is identical with the drinking of it. Mind or no mind, that world exists as an extra-personal affair,—Pragmatism to the contrary notwithstanding."

The world of mathematics is not a mere fantastical construction but it is the reconstruction of a world of necessary relations, and as such it possesses an objective significance. It is not man-made nor mind-made nor purely ideal fancy but eternal and of objective significance. The domain of this world of mathematics must be exploited as much as the domain of natural science. Professor Keyser says:

"Just as the astronomer, the physicist, the geologist, or other student of objective science looks abroad in the world of sense, so, not metaphorically speaking but literally, the mind of the mathematician goes forth into the universe of logic in quest of the things that are there; exploring the heights and depths for facts—ideas, classes, relationships, implications, and the rest; observing the minute and elusive with the powerful microscope of his Infinitesimal Analysis; observing the elusive and vast with the limitless telescope of his Calculus of the Infinite; making guesses regarding the order and internal harmony of the data observed and collated; testing the hypotheses, not merely by the complete induction peculiar to mathematics, but, like his colleague of the outer world, resorting also to experimental tests and incomplete induction; frequently finding it necessary, in view of unforeseen disclosures, to abandon a once hopeful hypothesis or to transform it by retrenchment or by enlargement:—thus, in his own domain, matching, point for point, the processes, methods and experience familiar to the devotee of natural science."

THE PERSISTENT PROBLEMS OF PHILOSOPHY. An Introduction to Metaphysics Through the Study of Modern Systems. By *Mary Whiton Calkins.* New York: Macmillan, 1907. Pp. xxii, 575. Price $2.50 net.

The author says in the preface, "I have audaciously attempted to combine what seem to me the essential features of a systematic Introduction to Metaphysics with those of a History of Modern Philosophy. This I have done both because I believe that the problems of philosophy are, at the outset, best studied as formulated in the actual systems of great thinkers, and because the historical sequence of philosophies, from Descartes's to Hegel's, seems to coincide, roughly, with a logical order."

In order to accomplish this task the author has classified the best known

philosophers as numerically monistic and numerically pluralistic, and again as qualitatively monistic and qualitatively pluralistic. Here is the scheme.

Qualitatively pluralistic: Descartes and Locke.

Qualitatively Monistic: (1) *Non-idealistic,* Hobbes; (2) *Idealistic,* (a) *Spiritualistic,* Leibnitz and Berkeley; (b) *Phenomenalistic,* Hume.

Qualitatively Pluralistic: Spinoza.

Qualitatively Monistic: *Idealistic, Spiritualistic*: Schopenhauer and Hegel.

Dualism so far as we understand is as different from pluralism as it is from monism, yet in Miss Calkins's scheme it is treated as a form of pluralism.

The omission of Kant is explained thus:

"Kant, in spite of his unequalled influence on nineteeenth-century philosophy, as well as Fichte and Schelling, are not referred to in this table, on the ground that their systems, as internally inconsistent, fail to represent any one type of philosophy."

Kant receives a special treatment in Chapter VII entitled "An Attack upon Dualism and Phenomenalism," while Fichte and Schelling are treated in Chapter IX as an "Advance Toward Monistic Spiritualism."

While these several philosophers might not be pleased to find themselves so labeled and subsumed under categories which do not seem to cover the requirements, Miss Calkins makes up for any coloring which this treatment of the different philosophies receive by many quotations and references, which of course will be most serviceable to the student for whose use the book is mainly intended.

Essays Philosophical and Psychological. In Honor of William James, Professor in Harvard University. By his Colleagues of Columbia University. London: Longmans, Green, 1908. Pp. 610.

According to the prefatory note this volume is intended to mark in some degree its authors' sense of Professor James's memorable services in philosophy and psychology, the vitality he has added to those studies, and the encouragement that has flowed from him to colleagues without number. Early in 1907, at the invitation of Columbia University, he delivered a course of lectures there, and met the members of the philosophical and psychological departments on several occasions for social discussion. They acknowledge an added motive for the present work in the recollections of this visit.

To enumerate the authors is to call the roll of the faculty of the departments of philosophy and psychology in Columbia University in 1907, and the subjects cover the range of realism, idealism, pragmatism, ethics, methodology and history of philosophy.

Scholasticism, Old and New. By *M. de Wulf.* Translated by *P. Coffey, D. Ph.* New York: Benziger, 1907. Pp. 327.

This is the translation of the author's *Introduction à la philosophie néo-scolastique* which was written with the object in view to "combat false conceptions, to coordinate true notions and so to furnish the reader with some general information on the new scholasticism." The book treats separately in two parts "Medieval Scholastic Philosophy" and "Modern Scholastic Philosophy" and in these the author has attempted to compare point by point the

ideas of the past with those of the present. The book bears the *imprimatur* of the Archbishop of New York, and the author states in his preface that this volume contains the program of instruction which the Institute of Philosophy of Louvain University has outlined for itself and is endeavoring to carry out.

In the history of American philosophy the Concord school plays an important part and represents a delightful period in which thinkers of different dispositions but all animated with the love of philosuphical thought, met for friendly intercourse and discussion. Dr. Edmund Montgomery was one of them, and perhaps more than any of the others he represented the philosophical spirit as seen from the point of view of a physiologist. On his part he pointed out the significance of the life process for philosophhical consideration, and has stood for the same up to the present day when a book of his entitled *Philosophical Problems in the Light of Vital Organization* (a stately volume of over 460 pages) containing the matured results of his philosophy, has appeared bearing the imprint of G. P. Putnam's Sons. In this number of *The Monist* he presents his message to the world in an article which will render some points of his position clear. We regret to say that at the present moment Dr. Montgomery is dangerously ill at his home, Liendo Plantation, Hempstead, Texas. For those readers not familiar with details of American philosophers we will state here that Dr. Montgomery, as the name indicates, is of Scotch blood, and was educated in Germany at a time when the interest in philosophy was at its height. He studied medicine in German universities, specializing in his favorite subjects physiology and biology, and was at the same time carried away with the spirit of freedom which was agitating the German mind in the years of the German revolution of 1848.

At Frankfort on the Main he met Elizabet Ney, the famous disciple of Rauch, and an artist whose statuary in Marble Hall at Washington attracts the attention of visitors to the Capitol. (For further details see the article by Bride McNeil Taylor in *The Open Court,* Vol. XXI, p. 592.) She was engaged at that time in making her well-known bust of Schopenhauer, the only one that exists of the great pessimist. Dr. Montgomery married Elizabet Ney, and both joined a group of emigrants who wanted to build up an ideal community in the new world. They went to Texas where together they invested their little fortune in the Liendo Plantation, which is now under the supervision of their son.

The report of the Anthropological Museum of Berlin contains an article by A. von Le Coq on a Manichee-Uigurian manuscript found in Idiqut-Shahri. The manuscript is of great interest because it proves the influence of Zoroaster upon the later Manicheean religion. It is a sample only of a large number of other manuscripts which were discovered in an expedition under Prof. F. W. K. Müller, one of the most indefatigable workers of the Berlin ethnological museum. The manuscript here published is written in Uigurian writing, not in *Estrangelo* script as other Turkish manuscripts. The translation proves it to be the description of a fight between Zoroaster and a demon who is finally vanquished and killed. The name Zoroaster is spelled "Zrusc burchan."

VOL. XIX. APRIL, 1909. No. 2.

THE MONIST

AKBAR, EMPEROR OF INDIA.

A PICTURE OF LIFE AND CUSTOMS FROM THE SIXTEENTH CENTURY.*

THE student of India who would at the same time be an historian, discovers to his sorrow that the land of his researches is lamentably poor in historical sources. And if within the realm of historical investigation, a more seductive charm lies for him in the analysis of great personalities than in ascertaining the course of historical development, then verily may he look about in vain for such personalities in the antiquity and middle ages of India. Not that the princely thrones were wanting in great men in ancient India, for we find abundant traces of them in Hindu folk-lore and poetry, but these sources do not extend to establishing the realistic element in details and furnishing life-like portraits of the men themselves. That the Hindu has ever been but little interested in historical matters is a generally recognized fact. Religious and philosophical speculations, dreams of other worlds, of previous and future existences, have claimed the attention of thoughtful minds to a much greater degree than has historical reality.

The misty myth-woven veil which hangs over persons and events of earlier times, vanishes at the beginning of

* This article was an address delivered in abridged form by the author Dr. Richard von Garbe, Rector of Tübingen University, on the occasion of the birthday of King Wilhelm II of Württemberg, on February 25, 1909. It has been translated for *The Monist* by Lydia Gillingham Robinson.

the modern era which in India starts with the Mohammedan conquest, for henceforth the history of India is written by foreigners. Now we meet with men who take a decisive part in the fate of India, and they appear as sharply outlined, even though generally unpleasing, personalities.

Islam has justly been characterized as the caricature of a religion. Fanaticism and fatalism are two conspicuously irreligious emotions, and it is exactly these two emotions, which Islam understands how to arouse in savage peoples, to which it owes the part it has played in the history of the world, and the almost unprecedented success of its diffusion in Asia, Africa and Europe.

About 1000 A. D. India was invaded by the Sultan Mahmud of Ghasna. "With Mahmud's expedition into India begins one of the most horrible periods of the history of Hindustan. One monarch dethrones another, no dynasty continues in power, every accession to the throne is accompanied by the murder of kinsmen, plundering of cities, devastation of the lowlands and the slaughter of thousands of men, women and children of the predecessor's adherents; for five centuries northwest and northern India literally reeked with the blood of multitudes."[1] Mohammedan dynasties of Afghan, Turkish and Mongolian origin follow that of Ghasna. This entire period is filled with an almost boundless series of battles, intrigues, imbroglios and political revolutions; nearly all events had the one characteristic in common, that they took place amid murder, pillage and fire.

The most frightful spectacle throughout these reeking centuries is the terrible Mongolian prince Timur, a successor of Genghis-Khan, who fell upon India with his band of assassins in the year 1398 and before his entry into Delhi the capital, in which he was proclaimed Emperor of India,

[1] E. Schlagintweit, *Indien in Wort und Bild,* II, 26 f.

caused the hundred thousand prisoners whom he had captured in his previous battles in the Punjab, to be slaughtered in one single day, because it was too inconvenient to drag them around with him. So says Timur himself with shameless frankness in his account of the expedition, and he further relates that after his entry into Delhi, all three districts of the city were plundered "according to the will of God."[2] In 1526 Babu, a descendant of Timur, made his entry into Delhi and there founded the dominion of the Grand Moguls (i. e., of the great Mongols). The overthrow of this dynasty was brought about by the disastrous reign of Baber's successor Aurungzeb, a cruel, crafty and treacherous despot, who following the example of his ancestor Timur, spread terror and alarm around him in the second half of the seventeenth and the beginning of the eighteenth centuries. Even to-day Hindus may be seen to tremble when they meet the sinister fanatical glance of a Mohammedan.

Princes with sympathetic qualities were not entirely lacking in the seven centuries of Mohammedan dominion in India, and they shine forth as points of light from the gloomy horror of this time, but they fade out completely before the luminous picture of the man who governed India for half a century (1556-1605) and by a wise, gentle and just reign brought about a season of prosperity such as the land had never experienced in the millenniums of its history. This man, whose memory even to-day is revered by the Hindus, was a descendant of Baber, Abul Fath Jelâleddîn Muhammed, known by the surname Akbar "the Great," which was conferred upon the child even when he was named, and completely supplanted the name that properly belonged to him. And truly he justified the epithet, for great, fabulously great, was Akbar as man, general, statesman and ruler,—all in all a prince who deserves to

[2] A. Müller, *Der Islam im Morgen- und Abendland,* II, 300 f.

be known by every one whose heart is moved by the spectacle of true human greatness.[3]

When we wish to understand a personality we are in the habit of ascertaining the inherited characteristics, and investigating the influences exercised upon it by religion, family, environment, education, youthful impressions, experience, and so forth. Most men are easily comprehensible as the products of these factors. The more independent of all such influences, or the more in opposition to them, a personality develops, the more attractive and interesting will it appear to us. At the first glance it looks as if the Emperor Akbar had developed his entire character from himself and by his own efforts in total independence of all influences which in other cases are thought to determine the character and nature of a man. A Mohammedan, a Mongol, a descendant of the monster Timur, the son of a weak incapable father, born in exile, called when but a lad to the government of a disintegrated and almost annihilated realm in the India of the sixteenth century,—which means in an age of perfidy, treachery, avarice, and self-seeking,—Akbar appears before us as a noble man, susceptible to all grand and beautiful impressions, conscientious, unprejudiced, and energetic, who knew how to bring peace and order out of the confusion of the times, who throughout his reign desired the furtherance of his subjects' and not of his own interest, who while increasing the privileges

[3] From the literature on Emperor Akbar the following works deserve special mention: J. Talboys Wheeler, *The History of India from the Earliest Ages.* Vol. IV, Pt. I, "Mussulman Rule," London, 1876 (judges Akbar very unfairly in many places, but declares at the bottom of page 135, "The reign of Akbar is one of the most important in the history of India; it is one of the most important in the history of the world"); Mountstuart Elphinstone, *History of India, the Hindu and Mahometan Periods,* with notes and additions by E. B. Cowell, 9th ed., London, 1905; G. B. Malleson, *Akbar and the Rise of the Mughal Empire,* Oxford, 1890 (in W. W. Hunter's *Rulers of India*); A. Müller, *Der Islam im Morgen- und Abendland,* Vol. II, Berlin, 1887; but especially Count F. A. von Noer, *Kaiser Akbar, ein Versuch über die Geschichte Indiens im sechzehnten Jahrhundert,* Vol. I, Leyden, 1880; Vol. II, revised from the author's manuscript by Dr. Gustav von Buchwald, Leyden, 1885. In the preface to this work the original sources are listed and described; compare also M. Elphinstone, pp. 536, 537, note 45.

of the Mohammedans, not only also declared equality of rights for the Hindus but even actualized that equality, who in every conceivable way sought to conciliate his subjects so widely at variance with each other in race, customs, and religion, and who finally when the narrow dogmas of his religion no longer satisfied him, attained to a purified faith in God, which was independent of all formulated religions.

A closer observation, however, shows that the contrast is not quite so harsh between what according to our hypotheses Akbar should have been as a result of the forces which build up man, and what he actually became. His predilection for science and art Akbar had inherited from his grandfather Baber and his father Humâyun. His youth, which was passed among dangers and privations, in flight and in prison, was certainly not without a beneficial influence upon Akbar's development into a man of unusual power and energy. And of significance for his spiritual development was the circumstance that after his accession to the throne his guardian put him in the charge of a most excellent tutor, the enlightened and liberal minded Persian Mîr Abdullatîf, who laid the foundation for Akbar's later religious and ethical views. Still, however high we may value the influence of this teacher, the main point lay in Akbar's own endowments, his susceptibility for such teaching as never before had struck root with any Mohammedan prince. Akbar had not his equal in the history of Islam. "He is the only prince grown up in the Mohammedan creed whose endeavor it was to ennoble the limitation of this most separatistic of all religions into a true religion of humanity."[4]

Even the external appearance of Akbar appeals to us sympathetically. We sometimes find reproduced a miniature from Delhi which pictures Akbar as seated; in this the char-

[4] A. Müller, II, 416.

acteristic features of the Mongolian race appear softened and refined to a remarkable degree.* The shape of the head is rather round, the outlines are softened, the black eyes large, thoughtful, almost dreamy, and only very slightly slanting, the brows full and bushy, the lips somewhat prominent and the nose a tiny bit hooked. The face is beardless except for the rather thin closely cut moustache which falls down over the curve of the mouth in soft waves. According to the description of his son, the Emperor Jehângir, Akbar's complexion is said to have been the yellow of wheat; the Portuguese Jesuits who came to his court called it plainly white. Although not exactly beautiful, Akbar seemed beautiful to many of his contemporaries, including Europeans, probably because of the august and at the same time kind and winsome expression which his countenance bore. Akbar was rather tall, broad-shouldered, strongly built and had long arms and hands.

Akbar, the son of the dethroned Emperor Humâyun, was born on October 14, 1542, at Amarkot in Sindh, two years after his father had been deprived of his kingdom by the usurper Shêr Chân. After an exile of fifteen years, or rather after an aimless wandering and flight of that length, the indolent pleasure- and opium-loving Humâyun was again permitted to return to his capital in 1555,—not through his own merit but that of his energetic general Bairâm Chân, a Turk who in one decisive battle had overcome the Afghans, at that time in possession of the dominion. But Humâyun was not long to enjoy his regained throne; half a year later he fell down a stairway in his palace and died. In January 1556 Akbar, then thirteen years of age, ascended the throne. Because of his youthful years Bairâm Chân assumed the regency as guardian of the realm or "prince-father" as it is expressed in Hindî, and guided the wavering ship of state with a strong hand.

* Noer, II as frontispiece (comp. also pp. 327, 328); A. Müller, II, 417.

AKBAR, EMPEROR OF INDIA.

From Noer's *Kaiser Akbar,* (Frontispiece to Vol. II).

He overthrew various insurgents and disposed of them with cold cruelty. But after a few years he so aroused the illwill of Akbar by deeds of partiality, selfishness and violence that in March 1560 Akbar, then 17 years of age, decided to take the reins of government into his own hand. Deprived of his office and influence Bairâm Chân hastened to the Punjab and took arms against his Imperial Master. Akbar led his troops in person against the rebel and overcame him. When barefooted, his turban thrown around his neck, Bairâm Chân appeared before Akbar and prostrated himself before the throne, Akbar did not do the thing which was customary under such circumstances in the Orient in all ages. The magnanimous youth did not sentence the humiliated rebel to a painful death but bade him arise in memory of the great services which Bairâm Chân had rendered to his father and later to himself, and again assume his old place of honor at the right of the throne. Before the assembled nobility he gave him the choice whether he would take the governorship of a province, or would enjoy the favor of his master at court as a benefactor of the imperial family, or whether, accompanied by an escort befitting his rank, he would prefer to undertake a pilgrimage to Mecca.[5] Bairâm Chân was wise enough to choose the last, but on the way to Mecca he was killed by an Afghan and the news caused Akbar sincere grief and led him to take the four year old son of Bairâm Chân under his special protection.

Mâhum Anâga, the Emperor's nurse, for whom he felt a warm attachment and gratitude, a woman revengeful and ambitious but loyal and devoted to Akbar, had contributed in bringing about the fall of the regent. She had cared for the Emperor from his birth to his accession and amid the confusion of his youth had guarded him from danger; but for this service she expected her reward. She

[5] Noer, I, 131.

sought nothing less than in the rôle of an intimate confidante of the youthful Emperor to be secretly the actual ruler of India.

Mâhum Anâga had a son, Adham Chân by name, to whom at her suggestion Akbar assigned the task of reconquering and governing the province of Mâlwâ. Adham Chân was a passionate and violent man, as ambitious and avaricious as his mother, and behaved himself in Mâlwâ as if he were an independent prince. As soon as Akbar learned this he advanced by forced marches to Mâlwâ and surprised his disconcerted foster-brother before the latter could be warned by his mother. But Adham Chân had no difficulty in obtaining Akbar's forgiveness for his infringements.

On the way back to Agra, where the Emperor at that time was holding court, a noteworthy incident happened. Akbar had ridden alone in advance of his escort and suddenly found himself face to face with a powerful tigress who with her five cubs came out from the shrubbery across his path. His approaching attendants found the nineteen year old Emperor standing quietly by the side of the slaughtered beast which he had struck to the ground with a single blow of his sword. To how much bodily strength, intrepidity, cold-blooded courage and sure-sightedness this blow of the sword testified which dared not come the fraction of a second too late, may be judged by every one who has any conception of the spring of a raging tigress anxious for the welfare of her young. And we may easily surmise the thoughts which the sight aroused in the minds of the Mohammedan nobles in Akbar's train. At that moment many ambitious wishes and designs may have been carried to their grave.[6]

The Emperor soon summoned his hot-headed foster-brother Adham Chân to court in order to keep him well

[6] Noer, I, 141.

in sight for he had counted often enough on Akbar's affection for his mother Mâhum Anâga to save him from the consequences of his sins. Now Mâhum Anâga, her son and her adherents, hated the grand vizier with a deadly hatred because they perceived that they were being deprived of their former influence in matters of state. This hatred finally impelled Adham Chân to a senseless undertaking. The embittered man hatched up a conspiracy against the grand vizier and when one night in the year 1562 the latter was attending a meeting of political dignitaries on affairs of state in the audience hall of the Imperial palace, Adham Chân with his conspirators suddenly broke in and stabbed the grand vizier in the breast, whereupon his companions slew the wounded man with their swords. Even now the deluded Adham Chân counted still upon the Emperor's forbearance and upon the influence of his mother. Akbar was aroused by the noise and leaving his apartments learned what had happened. Adham Chân rushed to the Emperor, seized his arm and begged him to listen to his explanations. But the Emperor was beside himself with rage, struck the murderer with his fist so that he fell to the floor and commanded the terrified servants to bind him with fetters and throw him head over heals from the terrace of the palace to the courtyard below. The horrible deed was done but the wretch was not dead. Then the Emperor commanded the shattered body of the dying man to be dragged up the stairs again by the hair and to be flung once more to the ground.[7]

I have related this horrible incident in order to give Akbar's picture with the utmost possible faithfulness and without idealization. Akbar was a rough, strong-nerved man, who was seldom angry but whose wrath when once aroused was fearful. It is a blemish on his character that in some cases he permitted himself to be carried away to

[7] J. T. Wheeler, IV, I, 139, 140; Noer, I, 143, 144.

such cruel death sentences, but we must not forget that he was then dealing with the punishment of particularly desperate criminals, and that such severe judgments had always been considered in the Orient to be righteous and sensible. Not only in the Orient unfortunately,—even in Europe 200 years after Akbar's time tortures and the rack were applied at the behest of courts of law.

Mahum Anâga came too late to save her son. Akbar sought with tender care to console her for his dreadful end but the heart-broken woman survived the fearful blow of fate only about forty days. The Emperor caused her body to be buried with that of her son in one common grave at Delhi, and he himself accompanied the funeral procession. At his command a stately monument was erected above this grave which still stands to-day. His generosity and clemency were also shown in the fact that he extended complete pardon to the accomplices in the murder of the grand vizier and even permitted them to retain their offices and dignities because he was convinced that they had been drawn into the crime by the violent Adham Chân. In other ways too Akbar showed himself to be ready to grant pardon to an almost incomprehensible extent. Again and again when an insubordinate viceroy in the provinces would surrender after an unsuccessful uprising Akbar would let him off without any penalty, thus giving him the opportunity of revolting again after a short time.

It was an eventful time in which Akbar arrived at manhood in the midst of all sorts of personal dangers.

I will pass over with but few comments his military expeditions which can have no interest for the general public. When Akbar ascended the throne his realm comprised only a very small portion of the possessions which had been subject to his predecessors. With the energy which was a fundamental characteristic of his nature he once more took possession of the provinces which had been torn from the

empire, at the same time undertaking the conquest of new lands, and accomplished this task with such good fortune that in the fortieth year of his reign the empire of India covered more territory than ever before; that is to say, not only the whole of Hindustan including the peninsula Gujerat, the lands of the Indus and Kashmir but also Afghanistan and a larger part of the Dekkhan than had ever been subject to any former Padishah of Delhi. At this time while the Emperor had his residence at Lahore the phrase was current in India, "As lucky as Akbar."[8]

It was apparent often enough in the military expeditions that Akbar far surpassed his contemporaries in generalship. But it was not the love of war and conquest which drove him each time anew to battle; a sincere desire inspired by a mystical spirit impelled him to bring to an end the ceaseless strife between the small states of India by joining them to his realm, and thus to found a great united empire.[9]

More worthy of admiration than the subjugation of such large territories in which of course many others have also been successful, is the fact that Akbar succeeded in establishing order, peace, and prosperity in the regained and newly subjugated provinces. This he brought about by the introduction of a model administration, an excellent police, a regulated post service, and especially a just division of taxes.[10] Up to Akbar's time corruption had been a matter of course in the entire official service and enormous sums in the treasury were lost by peculation on the part of tax collectors.

Akbar first divided the whole realm into twelve and later into fifteen viceregencies, and these into provinces, administrative districts and lesser subdivisions, and gov-

[8] J. T. Wheeler, IV, I, 180.

[9] Noer, II, 8, 390, 423.

[10] For the following compare Noer I, 391 ff.; M. Elphinstone, 529 ff.; G. B. Malleson, 172 ff., 185 ff.

erned the revenues of the empire on the basis of a uniformly exact survey of the land. He introduced a standard of measurement, replacing the hitherto customary land measure (a leather strap which was easily lengthened or shortened according to the need of the measuring officer) by a new instrument of measurement in the form of a bamboo staff which was provided with iron rings at definite intervals. For purposes of assessment land was divided into four classes according to the kind of cultivation practiced upon it. The first class comprised arable land with a constant rotation of crops; the second, that which had to lie fallow for from one to two years in order to be productive; the third from three to four years; the fourth that land which was uncultivated for five years and longer or was not arable at all. The first two classes of acreage were taxed one-third of the crop, which according to our present ideas seems an exorbitantly high rate, and it was left to the one assessed whether he would pay the tax in kind or in cash. Only in the case of luxuries or manufactured articles, that is to say, where the use of a circulating medium could be assumed, was cash payment required. Whoever cultivated unreclaimed land was assisted by the government by the grant of a free supply of seed and by a considerable reduction in his taxes for the first four years.

Akbar also introduced a new uniform standard of coinage, but stipulated that the older coins which were still current should be accepted from peasants for their full face value. From all this the Indian peasants could see that Emperor Akbar not only desired strict justice to rule but also wished to further their interests, and the peasants had always comprised the greatest part of the inhabitants, (even according to the latest census in 1903, vol. I, p. 3, 50 to 84 percent of the inhabitants of India live by agriculture). But Akbar succeeded best in winning the hearts

of the native inhabitants by lifting the hated poll tax which still existed side by side with all other taxes.

The founder of Islam had given the philanthropical command to exterminate from the face of the earth all followers of other faiths who were not converted to Islam, but he had already convinced himself that it was impossible to execute this law. And, indeed, if the Mohammedans had followed out this precept, how would they have been able to overthrow land upon land and finally even thickly populated India where the so-called unbelievers comprised an overwhelming majority? Therefore in place of complete extermination the more practical arrangement of the poll tax was instituted, and this was to be paid by all unbelievers in order to be a constant reminder to them of the loss of their independence. This humiliating burden which was still executed in the strictest, most inconsiderate manner, Akbar removed in the year 1565 without regard to the very considerable loss to the state's treasury. Nine years later followed the removal of the tax upon religious assemblies and pilgrimages, the execution of which had likewise kept the Hindus in constant bitterness towards their Mohammedan rulers.

Sometime previous to these reforms Akbar had abolished a custom so disgusting that we can hardly comprehend that it ever could have legally existed. At any rate it alone is sufficient to brand Islam and its supreme contempt for followers of other faiths, with one of the greatest stains in the history of humanity. When a tax-collector gathered the taxes of the Hindus and the payment had been made, the Hindu was required "without the slightest sign of fear of defilement" to open his mouth in order that the tax collector might spit in it if he wished to do so.[11] This was much more than a disgusting humiliation. When the tax-collector availed himself of this privilege the Hindu

[11] Noer, II, 6, 7; G. B. Malleson, 174, 175.

lost thereby his greatest possession, his caste, and was shut out from any intercourse with his equals. Accordingly he was compelled to pass his whole life trembling in terror before this horrible evil which threatened him. That a man of Akbar's nobility of character should remove such an atrocious, yes devilish, decree seems to us a matter of course; but for the Hindus it was an enormous beneficence.

Akbar sought also to advance trade and commerce in every possible way. He regulated the harbor and toll duties, removed the oppressive taxes on cattle, trees, grain and other produce as well as the customary fees of subjects at every possible appointment or office. In the year 1574 it was decreed that the loss which agriculture suffered by the passage of royal troops through the fields should be carefully calculated and scrupulously replaced.

Besides these practical regulations for the advancement of the material welfare, Akbar's efforts for the ethical uplift of his subjects are noteworthy. Drunkenness and debauchery were punished and he sought to restrain prostitution by confining dancing girls and abandoned women in one quarter set apart for them outside of his residence which received the name *Shâitânpura* or "Devil's City."[12]

The existing corruption in the finance and customs department was abolished by means of a complicated and punctilious system of supervision (the bureaus of receipts and expenditures were kept entirely separated from each other in the treasury department,) and Akbar himself carefully examined the accounts handed in each month from every district, just as he gave his personal attention with tireless industry and painstaking care to every detail in the widely ramified domain of the administration of government. Moreover the Emperor was fortunate in having at the head of the finance department a prudent, energetic, perfectly honorable and incorruptible man, the Hindu To-

12 J. T. Wheeler, IV, I, 173; Noer, I, 438 n.

dar Mal, who without possessing the title of vizier or minister of state had assumed all the functions of such an office.

It is easily understood that many of the higher tax officials did not grasp the sudden break of a new day but continued to oppress and impoverish the peasants in the traditional way, but the system established by Akbar succeeded admirably and soon brought all such transgressions to light. Todar Mal held a firm rein, and by throwing hundreds of these faithless officers into prison and by making ample use of bastinado and torture, spread abroad such a wholesome terror that Akbar's reforms were soon victorious.

How essential it was to exercise the strictest control over men occupying the highest positions may be seen by the example of the feudal nobility whose members bore the title "Jâgîrdâr." Such a Jâgîrdâr had to provide a contingent of men and horses for the imperial army corresponding to the size of the estate which was given him in fief. Now it had been a universal custom for the Jâgîrdârs to provide themselves with fewer soldiers and horses on a military expedition than at the regular muster. Then too the men and horses often proved useless for severe service. When the reserves were mustered the knights dressed up harmless private citizens as soldiers or hired them for the occasion and after the muster was over, let them go again. In the same way the horses brought forward for the muster were taken back into private service immediately afterwards and were replaced by worthless animals for the imperial service. This evil too was abolished at one stroke, by taking an exact personal description of the soldiers presented and by branding the heads of horses, elephants and camels with certain marks. By this simple expedient it became impossible to exchange men and animals presented

at the muster for worthless material and also to loan them to other knights during muster.

The number of men able to bear arms in Akbar's realm has been given as about four and a half millions but the standing army which was held at the expense of the state was small in proportion. It contained only about twenty-five thousand men, one-half of whom comprised the cavalry and the rest musketry and artillery. Since India does not produce first class horses, Akbar at once provided for the importation of noble steeds from other lands of the Orient which were famed for horse breeding and was accustomed to pay more for such animals than the price which was demanded. In the same way no expense was too great for him to spend on the breeding and nurture of elephants, for they were very valuable animals for the warfare of that day. His stables contained from five to six thousand well-trained elephants. The breeding of camels and mules he also advanced with a practical foresight and understood how to overcome the widespread prejudice in India against the use of mules.

Untiringly did Akbar inspect stables, arsenals, military armories, and shipyards, and insisted on perfect order in all departments. He called the encouragement of seamanship an act of worship[13] but was not able to make India a maritime power.

Akbar had an especial interest in artillery, and with it a particular gift for the technique and great skill in mechanical matters. "He invented a cannon which could be taken apart to be carried more easily on the march and could be put up quickly, apparently for use in mountain batteries. By another invention he united seventeen cannons in such a way that they could be shot off simultaneously by one fuse.[14] Hence it is probably a sort of *mitrailleuse*. Akbar

[13] Noer, II, 378.

[14] Noer, I, 429. The second invention, however, is questioned by Buchwald (II, 372) because of the so-called "organ cannons" which were in use in Europe as early as the 15th century.

is also said to have invented a mill cart which served as a mill as well as for carrying freight. With regard to these inventions we must take into consideration the possibility that the real inventor may have been some one else, but that the flatterers at the court ascribed them to the Emperor because the initiative may have originated with him.

The details which I have given will suffice to show what perfection the military and civil administration attained through Akbar's efforts. Throughout his empire order and justice reigned and a prosperity hitherto unknown. Although taxes were never less oppressive in India than under Akbar's reign, the imperial income for one year amounted to more than $120,000,000, a sum at which contemporary Europe marveled, and which we must consider in the light of the much greater purchasing power of money in the sixteenth century.[15] A large part of Akbar's income was used in the erection of benevolent institutions, of inns along country roads in which travelers were entertained at the imperial expense, in the support of the poor, in gifts for pilgrims, in granting loans whose payment was never demanded, and many similar ways. To his encouragement of schools, of literature, art and science I will refer later.

Of decided significance for Akbar's success was his patronage of the native population. He did not limit his efforts to lightening the lot of the subjugated Hindus and relieving them of oppressive burdens; his efforts went deeper. He wished to educate the Mohammedans and Hindus to a feeling of mutual good-will and confidence, and in doing so he was obliged to contend in the one case against haughtiness and inordinate ambition, and in the other against hate and distrustful reserve. If with this end in view he actually favored the Hindus by keeping certain ones close to him and advancing them to the most

[15] Noer, I, 439.

influential positions in the state, he did it because he found characteristics in the Hindus (especially in their noblest race, the Rajputs) which seemed to him most valuable for the stability of the empire and for the promotion of the general welfare. He had seen enough faithlessness in the Mohammedan nobles and in his own relatives. Besides, Akbar was born in the house of a small Rajput prince who had shown hospitality to Akbar's parents on their flight and had given them his protection.

The Rajputs are the descendants of the ancient Indian warrior race and are a brave, chivalrous, trustworthy people who possess a love of freedom and pride of race quite different in character from the rest of the Hindus. Even to-day every traveler in India thinks he has been set down in another world when he treads the ground of Rajputâna and sees around him in place of the weak effeminate servile inhabitants of other parts of the country powerful upright men, splendid warlike figures with blazing defiant eyes and long waving beards.

While Akbar valued the Rajputs very highly his own personality was entirely fitted to please these proud manly warriors. An incident which took place before the end of the first year of Akbar's reign is characteristic of the relations which existed on the basis of this intrinsic relationship.[16]

Bihâri Mal was a prince of the small Rajput state Ambir, and possessed sufficient political comprehension to understand after Akbar's first great successes that his own insignificant power and the nearness of Delhi made it advisable to voluntarily recognize the Emperor as his liege lord. Therefore he came with son, grandson and retainers to swear allegiance to Akbar. Upon his arrival at the imperial camp before Delhi, a most surprising sight met his eyes. Men were running in every direction, fleeing wildly

[16] Noer, I, 224-226.

before a raging elephant who wrought destruction to everything that came within his reach. Upon the neck of this enraged brute sat a young man in perfect calmness belaboring the animal's head with the iron prong which is used universally in India for guiding elephants. The Rajputs sprang from their horses and came up perfectly unconcerned to observe the interesting spectacle, and broke out in loud applause when the conquered elephant knelt down in exhaustion. The young man sprang from its back and cordially greeted the Rajput princes (who now for the first time recognized Akbar in the elephant- tamer) bidding them welcome to his red imperial tent. From this occurrence dates the friendship of the two men. In later years Bihâri Mal's son and grandson occupied high places in the imperial service, and Akbar married a daughter of the Rajput chief who became the mother of his son and successor Selim, afterwards the Emperor Jehângir. Later on Akbar received a number of other Rajput women in his harem.

Not all of Akbar's relations to the Rajputs however were of such a friendly kind. As his grandfather Baber before him, he had many bitter battles with them, for no other Indian people had opposed him so vigorously as they. Their domain blocked the way to the south, and from their rugged mountains and strongly fortified cities the Rajputs harassed the surrounding country by many invasions and destroyed order, commerce and communication quite after the manner of the German robber barons of the Middle Ages. Their overthrow was accordingly a public necessity.

The most powerful of these Rajput chiefs was the Prince of Mewâr who had particularly attracted the attention of the Emperor by his support of the rebels. The control of Mewâr rested upon the possession of the fortress Chitor which was built on a monstrous cliff one hundred

and twenty meters high, rising abruptly from the plain and was equipped with every means of defence that could be contrived by the military skill of that time for an incomparably strong bulwark. On the plain at its summit which measured over twelve kilometers in circumference a city well supplied with water lay within the fortification walls. There an experienced general, Jaymal, "the Lion of Chitor," was in command. I have not time to relate the particulars of the siege, the laying of ditches and mines and the uninterrupted battles which preceded the fall of Chitor in February, 1568. According to Akbar's usual custom he exposed himself to showers of bullets without once being hit (the superstition of his soldiers considered him invulnerable) and finally the critical shot was one in which Akbar with his own hand laid low the brave commander of Chitor. Then the defenders considered their cause lost, and the next night saw a barbarous sight, peculiarly Indian in character: the so-called Jauhar demanded his offering according to an old Rajput custom. Many great fires gleamed weirdly in the fortress. To escape imprisonment and to save their honor from the horrors of captivity, the women mounted the solemnly arranged funeral pyres, while all the men, clad in saffron hued garments, consecated themselves to death. When the victors entered the city on the next morning a battle began which raged until the third evening, when there was no one left to kill. Eight thousand warriors had fallen, besides thirty thousand inhabitants of Chitor who had participated in the fight.

With the conquest of Chitor which I have treated at considerable length because it ended in a typically Indian manner, the resistance of the Rajputs broke down. After Akbar had attained his purpose he was on the friendliest terms with the vanquished. It testifies to his nobility of character as well as to his political wisdom that after this

complete success he not only did not celebrate a triumph, but on the contrary proclaimed the renown of the vanquished throughout all India by erecting before the gate of the imperial palace at Delhi two immense stone elephants with the statues of Jaymal, the "Lion of Chitor," and of the noble youth Pata who had performed the most heroic deeds in the defense of Chitor. By thus honoring his conquered foes in such a magnanimous manner Akbar found the right way to the heart of the Rajputs. By constant bestowal of favors he gradually succeeded in so reconciling the noble Rajputs to the loss of their independence that they were finally glad and proud to devote themselves to his service, and, under the leadership of their own princes, proved themselves to be the best and truest soldiers of the imperial army, even far from their home in the farthest limits of the realm.

The great masses of the Hindu people Akbar won over by lowering the taxes as we have previously related, and by all the other successful expedients for the prosperity of the country, but especially by the concession of perfect liberty of faith and worship and by the benevolent interest with which he regarded the religious practices of the Hindus. A people in whom religion is the ruling motive of life, after enduring all the dreadful sufferings of previous centuries for its religion's sake, must have been brought to a state of boundless reverence by Akbar's attitude. And since the Hindus were accustomed to look upon the great heroes and benefactors of humanity as incarnations of deity we shall not be surprised to read from an author of that time[17] that every morning before sunrise great numbers of Hindus crowded together in front of the palace to await the appearance of Akbar and to prostrate themselves as soon as he was seen at a window, at the same time singing religious hymns. This fanatical enthusiasm of the Hindus

[17] Badâonî in Noer, II, 320.

for his person Akbar knew how to retain not only by actual benefits but also by small, well calculated devices.

It is a familiar fact that the Hindus considered the Ganges to be a holy river and that cows were sacred animals. Accordingly we can easily understand Akbar's purpose when we learn that at every meal he drank regularly of water from the Ganges (carefully filtered and purified to be sure) calling it "the water of immortality,"[18] and that later he forbade the slaughtering of cattle and eating their flesh.[19] But Akbar did not go so far in his connivance with the Hindus that he considered all their customs good or took them under his protection. For instance he forbade child marriages among the Hindus, that is to say the marriage of boys under sixteen and of girls under fourteen years, and he permitted the remarriage of widows. The barbaric customs of Brahmanism were repugnant to his very soul. He therefore most strictly forbade the slaughtering of animals for purposes of sacrifice, the use of ordeals for the execution of justice, and the burning of widows against their will, which indeed was not established according to Brahman law but was constantly practiced according to traditional custom.[20] To be sure neither Akbar nor his successor Jehângir were permanently successful in their efforts to put an end to the burning of widows. Not until the year 1829 was the horrible custom practically done away with through the efforts of the English.

Throughout his entire life Akbar was a tirelessly industrious, restlessly active man. By means of ceaseless activity he struggled successfully against his natural tendency to melancholy and in this way kept his mind wholesome, which is most deserving of admiration in an Oriental monarch who was brought in contact day by day with immoderate flattery and idolatrous veneration. Well did

[18] Noer, II, 317, 318. [19] *Ibid.*, 376, 317.

[20] J. T. Wheeler, IV, I, 173; M. Elphinstone, 526; G. B. Malleson, 176.

Akbar know that no Oriental nation can be governed without a display of dazzling splendor; but in the midst of the fabulous luxury with which Akbar's court was fitted out and his camp on the march, in the possession of an incomparably rich harem which accompanied the Emperor on his expeditions and journeys in large palatial tents, Akbar always showed a remarkable moderation. It is true that he abolished the prohibition of wine which Islam had inaugurated and had a court cellar in his palace, but he himself drank only a little wine and only ate once a day and then did not fully satisfy his hunger at this one meal which he ate alone and not at any definite time.[21] Though he was not strictly a vegetarian yet he lived mainly on rice, milk, fruits and sweets, and meat was repulsive to him. He is said to have eaten meat hardly more than four times a year.[22]

Akbar was very fond of flowers and perfumes and especially enjoyed blooded doves whose care he well understood. About twenty thousand of these peaceful birds are said to have made their home on the battlements of his palace. His historian[23] relates: "His Majesty deigned to improve them in a marvelous manner by crossing the races which had not been done formerly."

Akbar was passionately fond of hunting and pursued the noble sport in its different forms, especially the tiger hunt and the trapping of wild elephants,[24] but he also hunted with trained falcons and leopards, owning no less than nine hundred hunting leopards. He was not fond of battue; he enjoyed the excitement and exertion of the actual hunt as a means for exercise and recreation, for training the eye and quickening the blood. Akbar took pleas-

[21] Noer, II, 355.

[22] J. T. Wheeler, IV, I, 169, following the old English geographer Samuel Purchas.

[23] Abul Fazl in Noer, I, 511.

[24] M. Elphinstone, 519.

ure also in games. Besides chess, cards and other games fights between animals may especially be mentioned, of which elephant fights were the most common, but there were also contests between camels, buffaloes, cocks, and even frogs, sparrows and spiders.

Usually, however, the whole day was filled up from the first break of dawn for Akbar with affairs of government and audiences, for every one who had a request or a grievance to bring forward could have access to Akbar, and he showed the same interest in the smallest incidents as in the greatest affairs of state. He also held courts of justice wherever he happened to be residing. No criminal could be punished there without his knowledge and no sentence of death executed until Akbar had given the command three times.[25]

Not until after sunset did the Emperor's time of recreation begin. Since he only required three hours of sleep[26] he devoted most of the night to literary, artistic and scientific occupations. Especially poetry and music delighted his heart. He collected a large library in his palace and drew the most famous scholars and poets to his court. The most important of these were the brothers Abul Faiz (with the *nom de plume* Faizî) and Abul Fazl who have made Akbar's fame known to the whole world through their works. The former at Akbar's behest translated a series of Sanskrit works into Persian, and Abul Fazl, the highly gifted minister and historian of Akbar's court (who to be sure can not be exonerated from the charge of flattery) likewise composed in the Persian language a large historical work written in the most flowery style which is the main source of our knowledge of that period. This famous work is divided in two parts, the first one of which under the title *Akbarnâme,* "Akbar Book," contains the complete

[25] J. T. Wheeler, IV, I, 168.

[26] *Loc. cit.*, 169.

history of Akbar's reign, whereas the second part, the *Aîn î Akbarî*, "The Institutions of Akbar," gives a presentation of the political and religious constitution and administration of India under Akbar's reign. It is also deserving of mention in this connection that Akbar instituted a board for contemporary chronicles, whose duty it was to compose the official record of all events relating to the Emperor and the government as well as to collect all laws and decrees.[27]

When Akbar's recreation hours had come in the night the poets of his court brought their verses. Translations of famous works in Sanskrit literature, of the New Testament and of other interesting books were read aloud, all of which captivated the vivacious mind of the Emperor from which nothing was farther removed than onesidedness and narrow-mindedness. Akbar had also a discriminating appreciation for art and industries. He himself designed the plans for some extremely beautiful candelabra, and the manufacture of tapestry reached such a state of perfection in India under his personal supervision that in those days fabrics were produced in the great imperial factories which in beauty and value excelled the famous rugs of Persia. With still more important results Akbar influenced the realm of architecture in that he discovered how to combine two completely different styles. For indeed, "the union of Mohammedan and Indian motives in the buildings of Akbar (who here as in all other departments strove to perfect the complete elevation of national and religious details) to form an improved third style,"[28] is entirely original.

Among other ways Akbar betrayed the scientific trend of his mind by sending out an expedition in search of the sources of the Ganges.[29] That a man of such a wonderful

[27] Noer, I, 432, 433.

[28] A. Müller, II, 386.

[29] J. T. Wheeler, IV, I, 174.

degree of versatility should have recognized the value of general education and have devoted himself to its improvement, we would simply take for granted. Akbar caused schools to be erected throughout his whole kingdom for the children of Hindus and Mohammedans, whereas he himself did not know how to read or write.[30] This remarkable fact would seem incredible to us after considering all the above mentioned facts if it was not confirmed by the express testimony of his son, the Emperor Jehângir. At any rate for an illiterate man Akbar certainly accomplished an astonishing amount. The universal character of the endowments of this man could not have been increased by the learning of the schools.

I have now come to the point which arouses most strongly the universal human interest in Akbar, namely, to his religious development and his relation to the religions, or better to religion. But first I must protest against the position maintained by a competent scholar[31] that Akbar himself was just as indifferent to religious matters as was the house of Timur as a whole. Against this view we have the testimony of the conscientiousness with which he daily performed his morning and evening devotions, the value which he placed upon fasting and prayer as a means of self-discipline, and the regularity with which he made yearly pilgrimages to the graves of Mohammedan saints. A better insight into Akbar's heart than these regular observances of worship which might easily be explained by the force of custom is given by the extraordinary manifestations of a devout disposition. When we learn that Akbar invariably prayed at the grave of his father in Delhi[32] before starting upon any important undertaking, or that during the siege of Chitor he made a vow to make a pilgrimage

[30] J. T. Wheeler, *loc. cit.*, 141; Noer, I, 193; II, 324, 326.

[31] A. Müller, II, 418.

[32] Noer, I, 262.

to a shrine in Ajmir after the fall of the fortress, and that after Chitor was in his power he performed this journey in the simplest pilgrim garb, tramping barefooted over the glowing sand,[33] it is impossible for us to look upon Akbar as irreligious. On the contrary nothing moved the Emperor so strongly and insistently as the striving after religious truth. This effort led to a struggle against the most destructive power in his kingdom, against the Mohammedan priesthood. That Akbar, the conqueror in all domains, should also have been victorious in the struggle against the encroachments of the Church (the bitterest struggle which a ruler can undertake), this alone should insure him a place among the greatest of humanity.

The Mohammedan priesthood, the community of the Ulemâs in whose hands lay also the execution of justice according to the dictates of Islam, had attained great prosperity in India by countless large bequests. Its distinguished membership formed an influential party at court. This party naturally represented the Islam of the stricter observance, the so-called Sunnitic Islam, and displayed the greatest severity and intolerance towards the representatives of every more liberal interpretation and towards unbelievers. The chief judge of Agra sentenced men to death because they were Shiïtes, that is to say they belonged to the other branch of Islam, and the Ulemâs urged Akbar to proceed likewise against the heretics.[34] That arrogance and vanity, selfishness and avarice, also belonged to the character of the Ulemâs is so plainly to be taken for granted according to all analogies that it need hardly be mentioned. The judicature was everywhere utilized by the Ulemâs as a means for illegitimate enrichment.

This ecclesiastical party which in its narrow-minded folly considered itself in possession of the whole truth,

[33] Noer, I, 259.

[34] J. T. Wheeler, IV, I, 156.

stands opposed to the noble skeptic Akbar, whose doubt of the divine origin of the Koran and of the truth of its dogmas began so to torment him that he would pass entire nights sitting out of doors on a stone lost in contemplation. The above mentioned brothers Faizî and Abul Fazl introduced to his impressionable spirit the exalted teaching of Sûfism, the Mohammedan mysticism whose spiritual pantheism had its origin in, or at least was strongly influenced by, the doctrine of the All-One, held by the Brahman Vedânta system. The Sûfi doctrine teaches religious tolerance and has apparently strengthened Akbar in his repugnance towards the intolerant exclusiveness of Sunnitic Islam.

The Ulemâs must have been horror-stricken when they found out that Akbar even sought religious instruction from the hated Brahmans. We hear especially of two, Purushottama and Debî by name, the first of whom taught Sanskrit and Brahman philosophy to the Emperor in his palace, whereas the second was drawn up on a platform to the wall of the palace in the dead of the night and there, suspended in midair, gave lessons on profound esoteric doctrines of the Upanishads to the emperor as he sat by the window. A characteristic bit of Indian local color! The proud Padishah of India, one of the most powerful rulers of his time, listening in the silence of night to the words of the Brahman suspended there outside, who himself as proud as the Emperor would not set foot inside the dwelling of one who in his eyes was unclean, but who would not refuse his wisdom to a sincere seeker after truth.

Akbar left no means untried to broaden his religious outlook. From Gujerat he summoned some Parsees, followers of the religion of Zarathustra, and through them informed himself of their faith and their highly developed system of ethics which places the sinful thought on the same level with the sinful word and act.

From olden times the inhabitants of India have had a predisposition for religious and philosophical disputations. So Akbar, too, was convinced of the utility of free discussion on religious dogmas. Based upon this idea, and perhaps also in the hope that the Ulemâs would be discomfited Akbar founded at Fathpur Sikrî, his favorite residence in the vicinity of Agra, the famous 'Ibâdat Khâna, literally the "house of worship," but in reality the house of controversy. This was a splendid structure composed of four halls in which scholars and religious men of all sects gathered together every Thursday evening and were given an opportunity to defend their creeds in the presence and with the cooperation of the Emperor. Akbar placed the discussion in charge of the wise and liberal minded Abul Fazl. How badly the Ulemâs, the representatives of Mohammedan orthodoxy, came off on these controversial evenings was to be foreseen. Since they had no success with their futile arguments they soon resorted to cries of fury, insults for their opponents and even to personal violence, often turning against each other and hurling curses upon their own number. In these discussions the inferiority of the Ulemâs, who nevertheless had always put forth such great claims, was so plainly betrayed that Akbar learned to have a profound contempt for them.

In addition to this, the fraud and machinations by means of which the Ulemâs had unlawfully enriched themselves became known to the Emperor. At any rate there was sufficient ground for the chastisement which Akbar now visited upon the high clergy. In the year 1579 a decree was issued which assigned to the Emperor the final decision in matters of faith, and this was subscribed to by the chiefs of the Ulemâs,—with what personal feelings we can well imagine. For by this act the Ulemâs were deprived of their ecclesiastical authority which was transferred to the Emperor. That the Orient too possesses its particular of-

ficial manner of expression in administrative matters is very prettily shown by a decree in which Akbar "granted the long cherished wish" of these same chiefs of the Ulemâs to undertake the pilgrimage to Mecca, which of course really meant a banishment of several years. Other unworthy Ulemâs were displaced from their positions or deprived of their sinecures; others who in their bitterness had caused rebellion or incited or supported mutiny were condemned for high treason. The rich property of the churches was for the most part confiscated and appropriated for the general weal. In short, the power and influence of the Ulemâs was completely broken down, the mosques stood empty and were transformed into stables and warehouses.

Akbar had long ceased to be a faithful Moslem. Now after the fall of the Ulemâs he came forward openly with his conviction, declared the Koran to be a human compilation and its commands folly, disputed the miracles of Mohammed and also the value of his prophecies, and denied the doctrine of recompense after death. He professed the Brahman and Sûfistic doctrine that the soul migrates through countless existences and finally attains divinity after complete purification.

The assertion of the Ulemâs that every person came into the world predisposed towards Islam and that the natural language of mankind was Arabic (the Jews made the same claim for Hebrew and the Brahmans for Sanskrit), Akbar refuted by a drastic experiment which does not correspond with his usual benevolence, but still is characteristic of the tendency of his mind. In this case a convincing demonstration appeared to him so necessary that some individuals would have to suffer for it. Accordingly in the year 1579 he caused twenty infants to be taken from their parents in return for a compensation and brought up under the care of silent nurses in a remote spot

in which no word should be spoken. After four years it was proved that as many of these unhappy children as were still alive were entirely dumb and possessed no trace of a predisposition for Islam.[35] Later the children are said to have learned to speak with extraordinary difficulty as was to be expected.

Akbar's repugnance to Islam developed into a complete revulsion against every thing connected with this narrow religion and made the great Emperor petty-souled in this particular. The decrees were dated from the death of Mohammed and no longer from the Hejra (the flight from Mecca to Medina). Books written in Arabic, the language of the Koran were given the lowest place in the imperial library. The knowledge of Arabic was prohibited, even the sounds characteristically belonging to this language were avoided.[36] Where formerly according to ancient tradition had stood the word *Bismillâhi*, "in the name of God," there now appeared the old war cry *Allâhu akbar,* "God is great," which came into use the more generally—on coins, documents, etc.— the more the courtiers came to reverse the sense of the slogan and to apply to it the meaning, "Akbar is God."

Before I enter into the Emperor's assumption of this flattery and his conception of the imperial dignity as conferred by the grace of God, I must speak of the interesting

[35] J. T. Wheeler, IV, I, 174; Noer, I, 511, 512. A familiar classical parallel to this incident is the experiment recorded by Herodotus (II, 2) which the Egyptian king Psammetich is said to have performed with two infants. It is related that after being shut up in a goat's stable for two years separated from all human intercourse these children repeatedly cried out the alleged Phrygian word *βεκός*, "bread," which in reality was probably simply an imitation of the bleating of the goats. Compare Edward B. Tyler, *Researches into the Early History of Mankind.* 2d edition, (London, 1870), page 81: "It is a very trite remark that there is nothing absolutely incredible in the story and that *Bek, bek* is a good imitative word for bleating as in *βληχάομαι, μηκάομαι, blöken, meckern,* etc." Farther on we find the account of a similar attempt made by James IV of Scotland as well as the literature with regard to other historical and legendary precedents of this sort in both Orient and Occident.

[36] Noer, II, 324, 325. Beards which the Koran commanded to be worn Akbar even refused to allow in his presence. M. Elphinstone, 525; G. B. Malleson, 177.

attempts of the Jesuits to win over to Christianity the most powerful ruler of the Orient.

As early as in the spring of 1578 a Portuguese Jesuit who worked among the Bengals as a missionary appeared at the imperial court and pleased Akbar especially because he got the better of the Ulemâs in controversy. Two years later Akbar sent a very polite letter to the Provincial of the Jesuit order in Goa, requesting him to send two Fathers in order that Akbar himself might be instructed "in their faith and its perfection." It is easy to imagine how gladly the Provincial assented to this demand and how carefully he proceeded with the selection of the fathers who were to be sent away with such great expectations. As gifts to the Emperor the Jesuits brought a Bible in four languages and pictures of Christ and the Virgin Mary, and to their great delight when Akbar received them he laid the Bible upon his head and kissed the two pictures as a sign of reverence.[37]

In the interesting work of the French Jesuit Du Jarric, published in 1611, we possess very detailed accounts of the operations of these missionaries who were honorably received at Akbar's court and who were invited to take up their residence in the imperial palace. The evening assemblies in the 'Ibâdat Khâna in Fathpur Sikrî at once gave the shrewd Jesuits who were schooled in dialectics, an opportunity to distinguish themselves before the Emperor who himself presided over this Religious Parliament in which Christians, Jews, Mohammedans, Brahmans, Buddhists and Parsees debated with each other. Abul Fazl speaks with enthusiasm in the *Akbarnâme* of the wisdom and zealous faith of Father Aquaviva, the leader of this Jesuit mission, and relates how he offered to walk into a fiery furnace with a New Testament in his hand if the Mullahs would do the same with the Koran in their hand, but that

[37] J. T. Wheeler, IV, I, 162; Noer, I, 481.

the Mohammedan priests withdrew in terror before this test by fire. It is noteworthy in this connection that the Jesuits at Akbar's court received a warning from their superiors not to risk such rash experiments which might be induced by the devil with the view of bringing shame upon Christianity.[38] The superiors were apparently well informed with regard to the intentions of the devil.

In conversation with the Jesuits Akbar proved to be favorably inclined towards many of the Christian doctrines and met his guests half way in every manner possible. They had permission to erect a hospital and a chapel and to establish Christian worship in the latter for the benefit of the Portuguese in that vicinity. Akbar himself occasionally took part in this service kneeling with bared head, which, however, did not hinder him from joining also in the Mohammedan ritual or even the Brahman religious practices of the Rajput women in his harem. He had his second son Murâd instructed by the Jesuits in the Portuguese language and in the Christian faith.

The Jesuits on their side pushed energetically toward their goal and did not scorn to employ flattery in so far as to draw a parallel between the Emperor and Christ, but no matter how slyly the fathers proceeded in the accomplishment of their plans Akbar was always a match for them. In spite of all concessions with regard to the excellence and credibility of the Christian doctrines the Emperor never seemed to be entirely satisfied. Du Jarric "complains bitterly of his obstinacy and remarks that the restless intellect of this man could never be quieted by one answer but must constantly make further inquiry."[39] The clever historian of Islam makes the following comment: "Bad, very bad;—perhaps he would not even be satisfied

[38] J. T. Wheeler, IV, I, 165, note, 47; M. Elphinstone, 523, note 8; G. B. Malleson, 162.

[39] In Noer, I, 485.

with the seven riddles of the universe of the latest natural science."[40]

To every petition and importunity of the Jesuits to turn to Christianity Akbar maintained a firm opposition. A second and third embassy which the order at Goa sent out in the nineties of the sixteenth century, also labored in vain for Akbar's conversion in spite of the many evidences of favor shown by the Emperor. One of the last Jesuits to come, Jerome Xavier of Navarre, is said to have been induced by the Emperor to translate the four Gospels into Persian which was the language of the Mohammedan court of India. But Akbar never thought of allowing himself to be baptized, nor could he consider it seriously from political motives as well as from reasons of personal conviction. A man who ordered himself to be officially declared the highest authority in matters of faith—to be sure not so much in order to found an imperial papacy in his country as to guard his empire from an impending religious war—at any rate a man who saw how the prosperity of his reign proceeded from his own personal initiative in every respect, such a man could countenance no will above his own nor subject himself to any pangs of conscience. To recognize the Pope as highest authority and simply to recognize as objective truth a finally determined system in the realm in which he had spent day and night in a hot pursuit after a clearer vision, was for Akbar an absolute impossibility.

Then too Akbar could not but see through the Jesuits although he appreciated and admired many points about them. Their rigid dogmatism, their intolerance and inordinate ambition could leave him no doubt that if they once arose to power the activity of the Ulemâs, once by good fortune overthrown, would be again resumed by them to a stronger and more dangerous degree. It is also probable that Akbar, who saw and heard everything, had learned

[40] A. Müller, II, 420 n.

of the horrors of the Inquisition at Goa. Moreover, the clearness of Akbar's vision for the realities of national life had too often put him on his guard to permit him to look upon the introduction of Christianity, however highly esteemed by him personally, as a blessing for Iindia. He had broken the power of Islam in India; to overthrow in like manner the second great religion of his empire, Brahmanism, to which the great majority of his subjects clung with body and soul, and then in place of both existing religions to introduce a third foreign religion inimically opposed to them—such a procedure would have hurled India into an irremediable confusion and destroyed at one blow the prosperity of the land which had been brought about by the ceaseless efforts of a lifetime. For of course it was not the aim of the Jesuits simply to win Akbar personally to Christianity but they wished to see their religion made the state religion of this great empire.

As has been already suggested, submission to Christianity would also have been opposed to Akbar's inmost conviction. He had climbed far enough up the stony path toward truth to recognize all religions as historically developed and as the products of their time and the land of their origin. All the nobler religions seemed to him to be radiations from the one eternal truth. That he thought he had found the truth with regard to the fate of the soul in the Sûfi-Vedântic doctrine of its migration through countless existences and its final ascension to deity has been previously mentioned. With such views Akbar could not become a Catholic Christian.

The conviction of the final reabsorption into deity, conditions also the belief in the emanation of the ego from deity. But Akbar's relation to God is not sufficiently identified with this belief. Akbar was convinced that he stood nearer to God than other people. This is already apparent in the title "The Shadow of God" which he had

assumed. The reversed, or rather the double, meaning of the sentence *Allâhu akbar,* "Akbar is God," was not displeasing to the Emperor as we know. And when the Hindus declared him to be an incarnation of a divinity he did not disclaim this homage. Such a conception was nothing unusual with the Hindus and did not signify a complete apotheosis. Although Akbar took great pains he was not able to permanently prevent the people from considering him a healer and a worker of miracles. But Akbar had too clear a head not to know that he was a man,—a man subject to mistakes and frailties; for when he permitted himself to be led into a deed of violence he had always experienced the bitterest remorse. Not the slightest symptom of Cæsaromania can be discovered in Akbar.

Akbar felt that he was a mediator between God and man and believed "that the deity revealed itself to him in the mystical illumination of his soul."[41] This conviction Akbar held in common with many rulers of the Occident who were much smaller than he. Idolatrous marks of veneration he permitted only to a very limited degree. He was not always quite consistent in this respect however, and we must realize how infinitely hard it was to be consistent in this matter at an Oriental court when the customary servility, combined with sincere admiration and reverence, longed to actively manifest itself.

Akbar, as we have already seen, suffered the Hindu custom of prostration, but on the other hand we have the express testimony to the contrary from the author Faizî, the trusted friend of the Emperor, who on the occasion of an exaggerated homage literally says: "The commands of His Majesty expressly forbid such devout reverence and as often as the courtiers offer homage of this kind because of their loyal sentiments His Majesty forbids them, for such manifestations of worship belong to God alone."[42] Finally

[41] Noer, II, 314, 355.

[42] In Noer, II, 409.

however Akbar felt himself moved to forbid prostration publicly, yet to permit it in a private manner, as appears in the following words of Abul Fazl[43]:

"But since obscurantists consider prostration to be a blasphemous adoration of man, His Majesty in his practical wisdom has commanded that it be put an end to with ignorant people of all stations and also that it shall not be practiced even by his trusted servants on public court days. Nevertheless if people upon whom the star of good fortune has shone are in attendance at private assemblies and receive permission to be seated, they may perform the prostration of gratitude by bowing their foreheads to the earth and so share in the rays of good fortune. So forbidding prostration to the people at large and granting it to the select the Emperor fulfils the wishes of both and gives the world an example of practical wisdom."

The desire to unite his subjects as much as possible finally impelled Akbar to the attempt to equalize religious differences as well. Convinced that religions did not differ from each other in their innermost essence, he combined what in his opinion were the essential elements and about the year 1580 founded a new religion, the famous Dîn i Ilâhî, the "religion of God." This religion recognizes only one God, a purely spiritual universally efficient being from whom the human soul is derived and towards which it tends. The ethics of this religion comprises the high moral requirements of Sufism and Parsism: complete toleration, equality of rights among all men, purity in thought, word and deed. The demand of monogamy, too, was added later. Priests, images and temples,—Akbar would have none of these in his new religion, but from the Parsees he took the worship of the fire and of the sun as to him light and its heat seemed the most beautiful symbol of the divine spirit.[44] He also adopted the holy cord of the

[43] In Noer, II, 347, 348.

[44] M. Elphinstone, 524.

Hindus and wore upon his forehead the colored token customary among them. In this eclectic manner he accommodated himself in a few externalities to the different religious communities existing in his kingdom.

Doubtless in the foundation of his Dîn i Ilâhi Akbar was not pursuing merely ideal ends but probably political ones as well, for the adoption of the new religion signified an increased loyalty to the Emperor. The novice had to declare himself ready to yield to the Emperor his property, his life, his honor, and his former faith, and in reality the adherents of the Dîn i Ilâhi formed a clan of the truest and most devoted servitors of the Emperor. It may not be without significance that soon after the establishment of the Dîn i Ilâhi a new computation of time was introduced which dated from the accession of Akbar to the throne in 1556.

After the new religion had been in existence perhaps five years the number of converts began to grow by the thousands but we can say with certainty that the greater portion of these changed sides not from conviction but on account of worldly advantage, since they saw that membership in the new religion was very advantageous to a career in the service of the state.[45] By far the greatest number of those who professed the Dîn i Ilâhi observed only the external forms, privately remaining alien to it.

In reality the new religion did not extend outside of Akbar's court and died out at his death. Hence if failure here can be charged to the account of the great Emperor, yet this very failure redounds to his honor. Must it not be counted as a great honor to Akbar that he considered it possible to win over his people to a spiritual imageless worship of God? Had he known that the religious requirements of the masses can only be satisfied by concrete objects of worship and by miracles (the more startling the

[45] Noer, I, 503.

better), that a spiritualized faith can never be the possession of any but a few chosen souls, he would not have proceeded with the founding of the Dîn i Ilâhi. And still we cannot call its establishment an absolute failure, for the spirit of tolerance which flowed out from Akbar's religion accomplished infinite good and certainly contributed just as much to lessening the antagonisms in India as did Akbar's social and industrial reforms.

A man who accomplished such great things and desired to accomplish greater, deserves a better fortune than was Akbar's towards the end of life. He had provided for his sons the most careful education, giving them at the same time Christian and orthodox Mohammedan instructors in order to lead them in their early years to the attainment of independent views by means of a comparison between contrasts; but he was never to have pleasure in his sons. It seems that he lacked the necessary severity. The two younger boys of this exceedingly temperate Emperor, Murâd and Daniâl, died of delirium tremens in their youth even before their father. The oldest son, Selim, later the Emperor Jehângir, was also a drunkard and was saved from destruction through this inherited vice of the Timur dynasty only by the wisdom and determination of his wife. But he remained a wild uncontrolled cruel man (as different as possible from his father and apparently so by intention) who took sides with the party of the vanquished Ulemâs and stepped forth as the restorer of Islam. In frequent open rebellion against his magnanimous father who was only too ready to pardon him, he brought upon this father the bitterest sorrow; and especially by having the trustworthy minister and friend of his father, Abul Fazl, murdered while on a journey. Very close to Akbar also was the loss of his old mother to whom he had clung his whole life long with a touching love and whom he outlived only a short time.

Akbar lost his best friends and his most faithful servants before he finally succumbed to a very painful abdominal illness, which at the last changed him also mentally to a very sad extent, and finally carried him off on the night of the fifteenth of October, 1605. He was buried at Sikandra near Agra in a splendid mausoleum of enormous proportions which he himself had caused to be built and which even to-day stands almost uninjured.

This in short is a picture of the life and activities of the greatest ruler which the Orient has ever produced. In order to rightly appreciate Akbar's greatness we must bear in mind that in his empire he placed all men on an equality without regard to race or religion, and granted universal freedom of worship at a time when the Jews were still outlaws in the Occident and many bloody persecutions occurred from time to time; when in the Occident men were imprisoned, executed or burnt at the stake for the sake of their faith or their doubts; at a time when Europe was polluted by the horrors of witch-persecution and the massacre of St. Bartholemew.[46] Under Akbar's rule India stood upon a much higher plane of civilization in the sixteenth century than Europe at the same time.

Germany should be proud that the personality of Akbar who according to his own words "desired to live at peace with all humanity, with every creature of God," has so inspired a noble German of princely blood in the last century that he consecrated the work of his life to the biography of Akbar. This man is the Prince Friedrich August of Schleswig-Holstein, Count of Noer, who wandered through the whole of Northern India on the track of Akbar's activities, and on the basis of the most careful investigation of sources has given us in his large two-volumed work the best and most extensive information which has been written in Europe about the Emperor Akbar. How much his

[46] Noer, I, 490 n.

work has been a labor of love can be recognized at every step in his book but especially may be seen in a touching letter from Agra written on the 24th of April, 1868, in which he relates that he utilized the early hours of this day for an excursion to lay a bunch of fresh roses on Akbar's grave and that no visit to any other grave had ever moved him so much as this.[47]

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[47] Noer, II, 564, 572.

A NEWLY DISCOVERED TREATISE OF ARCHIMEDES.

HEIBERG'S TRANSLATION FROM THE GREEK.[1]

GREAT credit is due to Prof. J. L. Heiberg of the department of Classical Philology at the University of Copenhagen for bringing to light and making accessible to the mathematical world this interesting document from the hand of Archimedes. Professor Heiberg spent some time while in Constantinople in the summer of 1906 in deciphering the manuscript which was preserved there together with a thirteenth century Euchologion in the cloister of the Holy Sepulchre. The Archimedes manuscript is inscribed in the beautiful miniscule of the tenth century, and though greatly faded is not so obliterated but that it is to some extent legible with the aid of a magnifying lens. It includes a number of Archimedean fragments which can be identified with references made by early mathematicians, but the most important discovery is that of the present treatise of which the restored text with philological notes was published in *Hermes* (XLII) preceded in a previous number by the German translation of Professor Heiberg which also appeared in the *Bibliotheca Mathematica* (VIII) accompanied by an extensive commentary by Prof. H. G. Zeuthen of the Department of Mathematics at Copenhagen. The present version has been revised by Professor Heiberg and contains some deviations from the German translation

[1] English version translated from the German by Lydia G. Robinson.

which are the more matured result of a renewed perusal and more exact decipherment of the text.

The treatise is rich in information with regard to the *modus operandi* of Archimedes and his general conception of mathematics as well as that of his predecessors. His style is so simple that where the text is complete the reader has no difficulty in understanding his clear exposition. His train of thought is so easily followed that the smaller gaps in the text may be filled with almost absolute certainty and such restorations are here indicated by brackets [ ]; it is even possible to conjecture the probable main point of an occasional lost demonstration from a close perusal of those preceding and following it.

ARCHIMEDES'S METHOD OF DERIVING GEOMETRICAL CONCLUSIONS FROM MECHANICAL PROPOSITIONS.

ARCHIMEDES TO ERATOSTHENES, GREETING:

Some time ago I sent you some theorems I had discovered, writing down only the propositions because I wished you to find their demonstrations which had not been given. The propositions of the theorems which I sent you were the following:

1. If in a perpendicular prism with a parallelogram[2] for base a cylinder is inscribed which has its bases in the opposite parallelograms[2] and its surface touching the other planes of the prism, and if a plane is passed through the center of the circle that is the base of the cylinder and one side of the square lying in the opposite plane, then that plane will cut off from the cylinder a section which is bounded by two planes, the intersecting plane and the one in which the base of the cylinder lies, and also by as much of the surface of the cylinder as lies between these same planes; and the detached section of the cylinder is $\frac{1}{6}$ of the whole prism.

2. If in a cube a cylinder is inscribed whose bases lie in opposite parallelograms[2] and whose surface touches the other four planes, and if in the same cube a second cylinder is inscribed whose bases lie in two other parallelograms[2] and whose surface touches the four other planes, then the body enclosed by the surface of the cylinder and comprehended within both cylinders will be equal to $\frac{2}{3}$ of the whole cube.

[2] This must mean a square.

These propositions differ essentially from those formerly discovered; for then we compared those bodies (conoids, spheroids and their segments) with the volume of cones and cylinders but none of them was found to be equal to a body enclosed by planes. Each of these bodies, on the other hand, which are enclosed by two planes and cylindrical surfaces is found to be equal to a body enclosed by planes. The demonstration of these propositions I am accordingly sending to you in this book.

Since I see, however, as I have previously said, that you are a capable scholar and a prominent teacher of philosophy, and also that you understand how to value a mathematical method of investigation when the opportunity is offered, I have thought it well to analyze and lay down for you in this same book a peculiar method by means of which it will be possible for you to derive instruction as to how certain mathematical questions may be investigated by means of mechanics. And I am convinced that this is equally profitable in demonstrating a proposition itself; for much that was made evident to me through the medium of mechanics was later proved by means of geometry because the treatment by the former method had not yet been established by way of a demonstration. For of course it is easier to establish a proof if one has in this way previously obtained a conception of the questions, than for him to seek it without such a preliminary notion. Thus in the familiar propositions the demonstrations of which Eudoxos was the first to discover, namely that a cone and a pyramid are one third the size of that cylinder and prism respectively that have the same base and altitude, no little credit is due to Democritos who was the first to make that statement about these bodies without any demonstration. But we are in a position to have found the present proposition in the same way as the earlier one; and I have decided to write down and make known the method partly because we have already talked about it heretofore and so no one would think that we were spreading abroad idle talk, and partly in the conviction that by this means we are obtaining no slight advantage for mathematics, for indeed I assume that some one among the investigators of to-day or in the future will discover by the method here set forth still other propositions which have not yet occurred to us.

In the first place we will now explain what was also first made clear to us through mechanics, namely that a segment of a parabola is $\frac{4}{3}$ of the triangle possessing the same base and equal altitude; following which we will explain in order the particular propositions

discovered by the above mentioned method; and in the last part of the book we will present the geometrical demonstrations of the propositions.[4]

1. If one magnitude is taken away from another magnitude and the same point is the center of gravity both of the whole and of the part removed, then the same point is the center of gravity of the remaining portion.

2. If one magnitude is taken away from another magnitude and the center of gravity of the whole and of the part removed is not the same point, the center of gravity of the remaining portion may be found by prolonging the straight line which connects the centers of gravity of the whole and of the part removed, and setting off upon it another straight line which bears the same ratio to the straight line between the aforesaid centers of gravity, as the weight of the magnitude which has been taken away bears to the weight of the one remaining [*De plan. aequil.* I, 8].

3. If the centers of gravity of any number of magnitudes lie upon the same straight line, then will the center of gravity of all the magnitudes combined lie also upon the same straight line [Cf. *ibid.* I, 5].

4. The center of gravity of a straight line is the center of that line [Cf. *ibid.* I, 4].

5. The center of gravity of a triangle is the point in which the straight lines drawn from the angles of a triangle to the centers of the opposite sides intersect [*Ibid.* I, 14].

6. The center of gravity of a parallelogram is the point where its diagonals meet [*Ibid.* I, 10].

7. The center of gravity [of a circle] is the center [of that circle].

8. The center of gravity of a cylinder [is the center of its axis].

9. The center of gravity of a prism is the center of its axis.

10. The center of gravity of a cone so divides its axis that the section at the vertex is three times as great as the remainder.

11. Moreover together with the exercise here laid down I will make use of the following proposition:

If any number of magnitudes stand in the same ratio to the same number of other magnitudes which correspond pair by pair, and if either all or some of the former magnitudes stand in any

[4] In his "Commentar," Professor Zeuthen calls attention to the fact that it was already known from Heron's recently discovered *Metrica* that these propositions were contained in this treatise, and Professor Heiberg made the same comment in *Hermes*.—Tr.

ratio whatever to other magnitudes, and the latter in the same ratio to the corresponding ones, then the sum of the magnitudes of the first series will bear the same ratio to the sum of those taken from the third series as the sum of those of the second series bears to the sum of those taken from the fourth series [*De Conoid.* I].

I.

Let $\alpha\beta\gamma$ [Fig. 1] be the segment of a parabola bounded by the straight line $\alpha\gamma$ and the parabola $\alpha\beta\gamma$. Let $\alpha\gamma$ be bisected at δ, $\delta\beta\epsilon$ being parallel to the diameter, and draw $\alpha\beta$, and $\beta\gamma$. Then the segment $\alpha\beta\gamma$ will be $\frac{4}{3}$ as great as the triangle $\alpha\beta\gamma$.

From the points α and γ draw $\alpha\zeta \,||\, \delta\beta\epsilon$, and the tangent $\gamma\zeta$; produce [$\gamma\beta$ to κ, and make $\kappa\theta = \gamma\kappa$]. Think of $\gamma\theta$ as a scale-beam with the center at κ and let $\mu\xi$ be any straight line whatever $||\, \epsilon\delta$. Now since $\gamma\beta\alpha$ is a parabola, $\gamma\zeta$ a tangent and $\gamma\delta$ an ordinate, then $\epsilon\beta = \beta\delta$; for this indeed has been proved in the Elements [i. e., of conic sections, cf. *Quadr. parab.* 2]. For this reason and because $\zeta\alpha$ and $\mu\xi \,||\, \epsilon\delta$, $\mu\nu = \nu\xi$, and $\zeta\kappa = \kappa\alpha$. And because $\gamma\alpha : \alpha\xi = \mu\xi : \xi o$ (for this is shown in a corollary, [cf. *Quadr. parab.* 5]), $\gamma\alpha : \alpha\xi = \gamma\kappa : \kappa\nu$; and $\gamma\kappa = \kappa\theta$, therefore $\theta\kappa : \kappa\nu = \mu\xi : \xi o$. And because ν is the center of gravity of the straight line $\mu\xi$, since $\mu\nu = \nu\xi$, then if we make $\tau\eta = \xi o$ and θ as its center of gravity so that $\tau\theta = \theta\eta$, the straight line $\tau\theta\eta$ will be in equilibrium with $\mu\xi$ in its present position because $\theta\nu$ is divided in inverse proportion to the weights $\tau\eta$ and $\mu\xi$, and $\theta\kappa : \kappa\nu = \mu\xi : \eta\tau$; therefore κ is the center of gravity of the combined weight of the two. In the same way all straight lines drawn in the triangle $\zeta\alpha\gamma \,||\, \epsilon\delta$ are in their present positions in equilibrium with their parts cut off by the parabola, when these are transferred to θ, so that κ is the center of gravity of the combined weight of the two. And because the triangle $\gamma\zeta\alpha$ consists of the straight lines in the triangle $\gamma\zeta\alpha$ and the

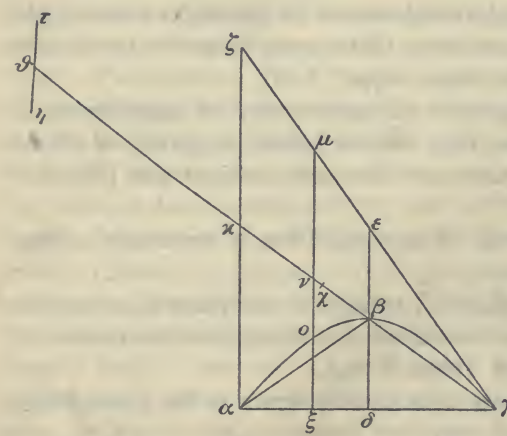

Fig. 1.

segment $\alpha\beta\gamma$ consists of those straight lines within the segment of the parabola corresponding to the straight line ξo, therefore the triangle $\zeta\alpha\gamma$ in its present position will be in equilibrium at the point κ with the parabola-segment when this is transferred to θ as its center of gravity, so that κ is the center of gravity of the combined weights of the two. Now let $\gamma\kappa$ be so divided at χ that $\gamma\kappa = 3\kappa\chi$; then χ will be the center of gravity of the triangle $\alpha\zeta\gamma$, for this has been shown in the Statics [cf. *De plan. aequil.* I, 15, p. 186, 3 with Eutokios, S. 320, 5ff.]. Now the triangle $\zeta\alpha\gamma$ in its present position is in equilibrium at the point κ with the segment $\beta\alpha\gamma$ when this is transferred to θ as its center of gravity, and the center of gravity of the triangle $\zeta\alpha\gamma$ is χ; hence triangle $\alpha\zeta\gamma$: segm. $\alpha\beta\gamma$ when transferred to θ as its center of gravity $= \theta\kappa : \kappa\chi$. But $\theta\kappa = 3\kappa\chi$; hence also triangle $\alpha\zeta\gamma = 3$ segm. $\alpha\beta\gamma$. But it is also true that triangle $\zeta\alpha\gamma = 4\triangle\alpha\beta\gamma$ because $\zeta\kappa = \kappa\alpha$ and $\alpha\delta = \delta\gamma$; hence segm. $\alpha\beta\gamma = \frac{4}{3}$ the triangle $\alpha\beta\gamma$. This is of course clear.

It is true that this is not proved by what we have said here; but it indicates that the result is correct. And so, as we have just seen that it has not been proved but rather conjectured that the result is correct we have devised a geometrical demonstration which we made known some time ago and will again bring forward farther on.

II.

That a sphere is four times as large as a cone whose base is equal to the largest circle of the sphere and whose altitude is equal to the radius of the sphere, and that a cylinder whose base is equal to the largest circle of the sphere and whose altitude is equal to the diameter of the circle is one and a half times as large as the sphere, may be seen by the present method in the following way:

Let $\alpha\beta\gamma\delta$ [Fig. 2] be the largest circle of a sphere and $\alpha\gamma$ and $\beta\delta$ its diameters perpendicular to each other; let there be in the sphere a circle on the diameter $\beta\delta$ perpendicular to the circle $\alpha\beta\gamma\delta$, and on this perpendicular circle let there be a cone erected with its vertex at α; producing the convex surface of the cone, let it be cut through γ by a plane parallel to its base; the result will be the circle perpendicular to $\alpha\gamma$ whose diameter will be $\epsilon\zeta$. On this circle erect a cylinder whose axis $= \alpha\gamma$ and whose vertical boundaries are $\epsilon\lambda$ and $\zeta\eta$. Produce $\gamma\alpha$ making $\alpha\theta = \gamma\alpha$ and think of $\gamma\theta$ as a scale-beam with its center at α. Then let $\mu\nu$ be any straight line whatever drawn $\parallel\beta\delta$ intersecting the circle $\alpha\beta\gamma\delta$ in ξ and o, the

diameter $\alpha\gamma$ in σ, the straight line $\alpha\epsilon$ in π and $\alpha\zeta$ in ρ, and on the straight line $\mu\nu$ construct a plane perpendicular to $\alpha\gamma$; it will intersect the cylinder in a circle on the diameter $\mu\nu$; the sphere $\alpha\beta\gamma\delta$, in a circle on the diameter ξo; the cone $\alpha\epsilon\zeta$ in a circle on the diameter $\pi\rho$. Now because $\gamma\alpha \times \alpha\sigma = \mu\sigma \times \sigma\pi$ (for $\alpha\gamma = \sigma\mu$, $\alpha\sigma = \pi\sigma$), and $\gamma\alpha \times \alpha\sigma = \alpha\xi^2 = \xi\sigma^2 + \sigma\pi^2$ then $\mu\sigma \times \sigma\pi = \xi\sigma^2 + \sigma\pi^2$. Moreover, because $\gamma\alpha : \alpha\sigma = \mu\sigma : \sigma\pi$ and $\gamma\alpha = \alpha\theta$, therefore $\theta\alpha : \alpha\sigma = \mu\sigma : \sigma\pi = \mu\sigma^2 : \mu\sigma \times \sigma\pi$. But it has been proved that $\xi\sigma^2 + \sigma\pi^2 = \mu\sigma \times \sigma\pi$; hence $\alpha\theta : \alpha\sigma = \mu\sigma^2 : \xi\sigma^2 + \sigma\pi^2$. But it is true that $\mu\sigma^2 : \xi\sigma^2 + \sigma\pi^2 = \mu\nu^2 : \xi o^2 + \pi\rho^2$ = the circle in the cylinder whose diameter is $\mu\nu$: the circle in the cone whose diameter is $\pi\rho$ + the circle in the sphere whose diameter is ξo; hence $\theta\alpha : \alpha\sigma$ = the circle in the cylinder : the circle in the sphere + the circle in the cone. Therefore the circle in the cylinder in its present position will be in equilibrium at the point α with the two circles whose diameters are ξo and $\pi\rho$, if they are so transferred to θ that θ is the center of gravity of both. In the same way it can be shown that when another straight line is drawn in the parallelogram $\xi\lambda \parallel \epsilon\zeta$, and upon it a plane is erected perpendicular to $\alpha\gamma$, the circle produced in the cylinder in its present position will be in equilibrium at the point α with the two circles produced in the sphere and the cone when they are transferred and so arranged on the scale-beam at the point θ that θ is the center of gravity of both. Therefore if cylinder, sphere and cone are filled up with such circles then the cylinder in its present position will be in equilibrium at the point α with the sphere and the cone together, if they are transferred and so arranged on the scale-beam at the point θ that θ is the center of gravity of both. Now since the bodies we have mentioned are in equilibrium, the cylinder with κ as its center of gravity, the sphere and the cone transferred as we have said so that they have θ as center of gravity, then $\theta\alpha : \alpha\kappa$ = cylinder : sphere + cone. But $\theta\alpha = 2\alpha\kappa$, and hence also the cylinder = 2 × (sphere + cone). But it is also

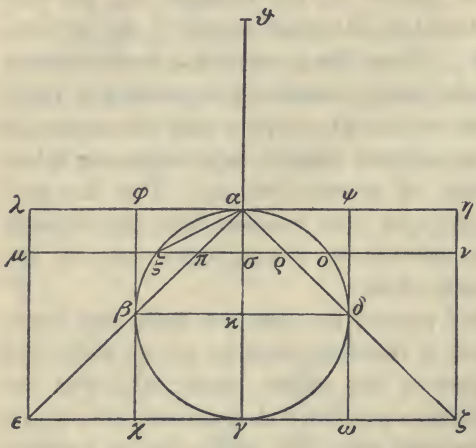

Fig. 2.

true that the cylinder = 3 cones [Euclid, *Elem.* XII, 10], hence 3 cones = 2 cones + 2 spheres. If 2 cones be subtracted from both sides, then the cone whose axes form the triangle $\alpha\epsilon\zeta$, = 2 spheres. But the cone whose axes form the triangle $\alpha\epsilon\zeta = 8$ cones whose axes form the triangle $\alpha\beta\delta$ because $\epsilon\zeta = 2\beta\delta$, hence the aforesaid 8 cones = 2 spheres. Consequently the sphere whose greatest circle is $\alpha\beta\gamma\delta$ is four times as large as the cone with its vertex at α, and whose base is the circle on the diameter $\beta\delta$ perpendicular to $\alpha\gamma$.

Draw the straight lines $\phi\beta\chi$ and $\psi\delta\omega \parallel \alpha\gamma$ through β and δ in the parallelogram $\lambda\zeta$ and imagine a cylinder whose bases are the circles on the diameters $\phi\psi$ and $\chi\omega$ and whose axis is $\alpha\gamma$. Now since the cylinder whose axes form the parallelogram $\phi\omega$ is twice as large as the cylinder whose axes form the parallelogram $\phi\delta$ and the latter is three times as large as the cone the triangle of whose axes is $\alpha\beta\delta$, as is shown in the Elements [Euclid, *Elem.* XII, 10], the cylinder whose axes form the parallelogram $\phi\omega$ is six times as large as the cone whose axes form the triangle $\alpha\beta\delta$. But it was shown that the sphere whose largest circle is $\alpha\beta\gamma\delta$ is four times as large as the same cone, consequently the cylinder is one and one half times as large as the sphere, Q. E. D.

After I had thus perceived that a sphere is four times as large as the cone whose base is the largest circle of the sphere and whose altitude is equal to its radius, it occurred to me that the surface of a sphere is four times as great as its largest circle, in which I proceeded from the idea that just as a circle is equal to a triangle whose base is the periphery of the circle and whose altitude is equal to its radius, so a sphere is equal to a cone whose base is the same as the surface of the sphere and whose altitude is equal to the radius of the sphere.

III.

By this method it may also be seen that a cylinder whose base is equal to the largest circle of a spheroid and whose altitude is equal to the axis of the spheroid, is one and one half times as large as the spheroid, and when this is recognized it becomes clear that if a spheroid is cut through its center by a plane perpendicular to its axis, one-half of the spheroid is twice as great as the cone whose base is that of the segment and its axis the same.

For let a spheroid be cut by a plane through its axis and let there be in its surface an ellipse $\alpha\beta\gamma\delta$ [Fig. 3] whose diameters are $\alpha\gamma$ and $\beta\delta$ and whose center is κ and let there be a circle in the

spheroid on the diameter $\beta\delta$ perpendicular to $\alpha\gamma$; then imagine a cone whose base is the same circle but whose vertex is at α, and producing its surface, let the cone be cut by a plane through γ parallel to the base; the intersection will be a circle perpendicular to $\alpha\gamma$ with $\epsilon\zeta$ as its diameter. Now imagine a cylinder whose base is the same circle with the diameter $\epsilon\zeta$ and whose axis is $\alpha\gamma$; let $\gamma\alpha$ be produced so that $\alpha\theta = \gamma\alpha$; think of $\theta\gamma$ as a scale-beam with its center at α and in the parallelogram $\lambda\zeta$ draw a straight line $\mu\nu \parallel \epsilon\zeta$, and on $\mu\nu$ construct a plane perpendicular to $\alpha\gamma$; this will intersect the cylinder in a circle whose diameter is $\mu\nu$, the spheroid in a circle whose diameter is ξo and the cone in a circle whose diameter is $\pi\rho$. Because $\gamma\alpha : \alpha\sigma = \epsilon\alpha : \alpha\pi = \mu\sigma : \sigma\pi$, and $\gamma\alpha = \alpha\theta$, therefore $\theta\alpha : \alpha\sigma = \mu\sigma : \sigma\pi$. But $\mu\sigma : \sigma\pi = \mu\sigma^2 : \mu\sigma \times \sigma\pi$ and $\mu\sigma \times \sigma\pi = \pi\sigma^2 + \sigma\xi^2$, for $\alpha\sigma \times \sigma\gamma : \sigma\xi^2 = \alpha\kappa \times \kappa\gamma : \kappa\beta^2 = \alpha\kappa^2 : \kappa\beta^2$ (for both ratios are equal to the ratio between the diameter and the parameter [Apollonius, *Con.* I, 21]) $= \alpha\sigma^2 : \sigma\pi^2$, therefore $\alpha\sigma^2 : \alpha\sigma \times \sigma\gamma = \pi\sigma^2 : \sigma\xi^2 = \sigma\pi^2 : \sigma\pi \times \pi\mu$, consequently $\mu\pi \times \pi\sigma = \sigma\xi^2$. If $\pi\sigma^2$ is added to both sides then $\mu\sigma \times \sigma\pi = \pi\sigma^2 + \sigma\xi^2$. Therefore $\theta\alpha : \alpha\sigma = \mu\sigma^2 : \pi\sigma^2 + \sigma\xi^2$. But $\mu\sigma^2 : \sigma\xi^2 + \sigma\pi^2 =$ the circle in the cylinder whose diameter is $\mu\nu$: the circle with the diameter ξo + the circle with the diameter $\pi\rho$; hence the circle whose diameter is $\mu\nu$ will in its present position be in equilibrium at the point α with the two circles whose diameters are ξo and $\pi\rho$ when they are transferred and so arranged on the scale-beam at the point α that θ is the center of gravity of both; and θ is the center of gravity of the two circles combined whose diameters are ξo and $\pi\rho$ when their position is changed, hence $\theta\alpha : \alpha\sigma =$ the circle with the diameter $\mu\nu$: the two circles whose diameters are ξo and $\pi\rho$. In the same way it can be shown that if another straight line is drawn in the parallelogram $\lambda\zeta \parallel \epsilon\zeta$ and on this line last drawn a plane is constructed perpendicular to $\alpha\gamma$, then likewise the circle produced in the cylinder will in its present position be in equilibrium at the point α with the two circles combined

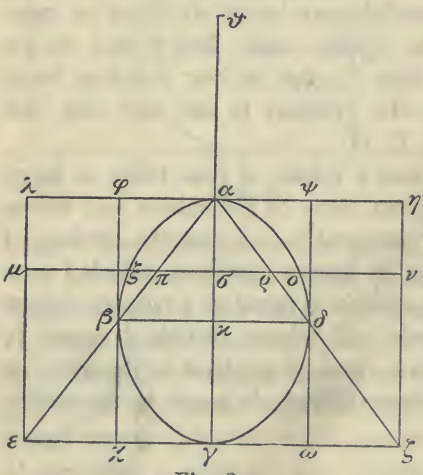

Fig. 3.

which have been produced in the spheroid and in the cone respectively when they are so transferred to the point θ on the scale-beam that θ is the center of gravity of both. Then if cylinder, spheroid and cone are filled with such circles, the cylinder in its present position will be in equilibrium at the point α with the spheroid + the cone if they are transferred and so arranged on the scale-beam at the point α that θ is the center of gravity of both. Now κ is the center of gravity of the cylinder, but θ, as has been said, is the center of gravity of the spheroid and cone together. Therefore $\theta\alpha : \alpha\kappa =$ cylinder : spheroid + cone. But $\alpha\theta = 2\alpha\kappa$, hence also the cylinder $= 2 \times$ (spheroid + cone) $= 2 \times$ spheroid $+ 2 \times$ cone. But the cylinder $= 3 \times$ cone, hence $3 \times$ cone $= 2 \times$ cone $+ 2 \times$ spheroid. Subtract $2 \times$ cone from both sides; then a cone whose axes form the triangle $\alpha\epsilon\zeta = 2 \times$ spheroid. But the same cone $= 8$ cones whose axes form the $\triangle \alpha\beta\delta$; hence 8 such cones $= 2 \times$ spheroid, $4 \times$ cone $=$ spheroid; whence it follows that a spheroid is four times as great as a cone whose vertex is at α, and whose base is the circle on the diameter $\beta\delta$ perpendicular to $\lambda\epsilon$, and one-half the spheroid is twice as great as the same cone.

In the parallelogram $\lambda\zeta$ draw the straight lines $\phi\chi$ and $\psi\omega \parallel \alpha\gamma$ through the points β and δ and imagine a cylinder whose bases are the circles on the diameters $\phi\psi$ and $\chi\omega$, and whose axis is $\alpha\gamma$. Now since the cylinder whose axes form the parallelogram $\phi\omega$ is twice as great as the cylinder whose axes form the parallelogram $\phi\delta$ because their bases are equal but the axis of the first is twice as great as the axis of the second, and since the cylinder whose axes form the parallelogram $\phi\delta$ is three times as great as the cone whose vertex is at α and whose base is the circle on the diameter $\beta\delta$ perpendicular to $\alpha\gamma$, then the cylinder whose axes form the parallelogram $\phi\omega$ is six times as great as the aforesaid cone. But it has been shown that the spheroid is four times as great as the same cone, hence the cylinder is one and one half times as great as the spheroid. Q. E. D.

IV.

That a segment of a right conoid cut by a plane perpendicular to its axis is one and one half times as great as the cone having the same base and axis as the segment, can be proved by the same method in the following way:

Let a right conoid be cut through its axis by a plane intersecting the surface in a parabola $\alpha\beta\gamma$ [Fig. 4]; let it be also cut

by another plane perpendicular to the axis, and let their common line of intersection be $\beta\gamma$. Let the axis of the segment be $\delta\alpha$ and let it be produced to θ so that $\theta\alpha = \alpha\delta$. Now imagine $\delta\theta$ to be a scale-beam with its center at α; let the base of the segment be the circle on the diameter $\beta\gamma$ perpendicular to $\alpha\delta$; imagine a cone whose base is the circle on the diameter $\beta\gamma$, and whose vertex is at α. Imagine also a cylinder whose base is the circle on the diameter $\beta\gamma$ and its axis $\alpha\delta$, and in the parallelogram let a straight line $\mu\nu$ be drawn $\| \beta\gamma$ and on $\mu\nu$ construct a plane perpendicular to $\alpha\delta$; it will intersect the cylinder in a circle whose diameter is $\mu\nu$, and the segment of the right conoid in a circle whose diameter is ξo. Now since $\beta\alpha\gamma$ is a parabola, $\alpha\delta$ its diameter and $\xi\sigma$ and $\beta\delta$ its ordinates, then [*Quadr. parab.* 3] $\delta\alpha : \alpha\sigma = \beta\delta^2 : \xi\sigma^2$. But $\delta\alpha = \alpha\theta$, therefore $\theta\alpha : \alpha\sigma = \mu\sigma^2 : \sigma\xi^2$. But $\mu\sigma^2 : \sigma\xi^2 =$ the circle in the cylinder whose diameter is $\mu\nu$: the circle in the segment of the right conoid whose diameter is ξo, hence $\theta\alpha : \alpha\sigma =$ the circle with the diameter $\mu\nu$: the circle with the diameter ξo; therefore the circle in the cylinder whose diameter is $\mu\nu$ is in its present position, in equilibrium at the point α with the circle whose diameter is ξo if this be transferred and so arranged on the scale-beam at θ that θ is its center of gravity. And the center of gravity of the circle whose diameter is $\mu\nu$ is at σ, that of the circle whose diameter is ξo when its position is changed, is θ, and we have the inverse proportion, $\theta\alpha : \alpha\sigma =$ the circle with the diameter $\mu\nu$: the circle with the diameter ξo. In the same way it can be shown that if another straight line be drawn in the parallelogram $\epsilon\gamma \| \beta\gamma$ the circle formed in the cylinder, will in its present position be in equilibrium at the point α with that formed in the segment of the right conoid if the latter is so transferred to θ on the scale-beam that θ is its center of gravity. Therefore if the cylinder and the segment of the right conoid are filled up then the cylinder in its present position will be in equilibrium at the point α with the segment of the right conoid if the latter is transferred and so arranged on the scale-beam at θ that θ is its center of gravity. And since these magnitudes are in equi-

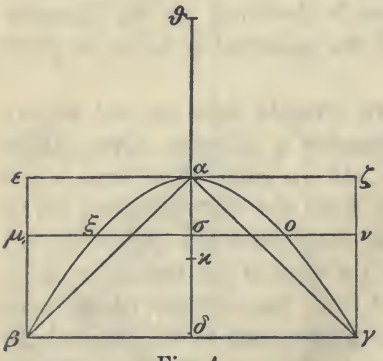

Fig. 4.

librium at α, and κ is the center of gravity of the cylinder, if $\alpha\delta$ is bisected at κ and θ is the center of gravity of the segment transferred to that point, then we have the inverse proportion $\theta\alpha : \alpha\kappa =$ cylinder : segment. But $\theta\alpha = 2\alpha\kappa$ and also the cylinder $= 2 \times$ segment. But the same cylinder is 3 times as great as the cone whose base is the circle on the diameter $\beta\gamma$ and whose vertex is at α; therefore it is clear that the segment is one and one half times as great as the same cone.

V.

That the center of gravity of a segment of a right conoid which is cut off by a plane perpendicular to the axis, lies on the straight line which is the axis of the segment divided in such a way that the portion at the vertex is twice as great as the remainder, may be perceived by our method in the following way:

Let a segment of a right conoid cut off by a plane perpendicular to the axis be cut by another plane through the axis, and let the intersection in its surface be the parabola $\alpha\beta\gamma$ [Fig. 5] and let the common line of intersection of the plane which cut off the segment and of the intersecting plane be $\beta\gamma$; let the axis of the segment and the diameter of the parabola $\alpha\beta\gamma$ be $\alpha\delta$; produce $\delta\alpha$ so that $\alpha\theta = \alpha\delta$ and imagine $\delta\theta$ to be a scale-beam with its center at α; then inscribe a cone in the segment with the lateral boundaries $\beta\alpha$ and $\alpha\gamma$ and in the parabola draw a straight line $\xi o \parallel \beta\gamma$ and let it cut the parabola in ξ and o and the lateral boundaries of the cone in π and ρ. Now because $\xi\sigma$ and $\beta\delta$ are drawn perpendicular to the diameter of the parabola, $\delta\alpha : \alpha\sigma = \beta\delta^2 : \xi\sigma^2$ [*Quadr. parab.* 3]. But $\delta\alpha : \alpha\sigma = \beta\delta : \pi\sigma = \beta\delta^2 : \beta\delta \times \pi\sigma$, therefore also $\beta\delta^2 : \xi\sigma^2 = \beta\delta^2 : \beta\delta \times \pi\sigma$. Consequently $\xi\sigma^2 = \beta\delta \times \pi\sigma$ and $\beta\delta : \xi\sigma = \xi\sigma : \pi\sigma$, therefore $\beta\delta : \pi\sigma = \xi\sigma^2 : \sigma\pi^2$. But $\beta\delta : \pi\sigma = \delta\alpha : \alpha\sigma = \theta\alpha : \alpha\sigma$, therefore also $\theta\alpha : \alpha\sigma = \xi\sigma^2 : \sigma\pi^2$. On ξo construct a plane perpendicular to $\alpha\delta$; this will intersect the segment of the right conoid in a circle whose diameter is ξo and the cone in a circle whose diameter is $\pi\rho$. Now because $\theta\alpha : \alpha\sigma = \xi\sigma^2 : \sigma\pi^2$

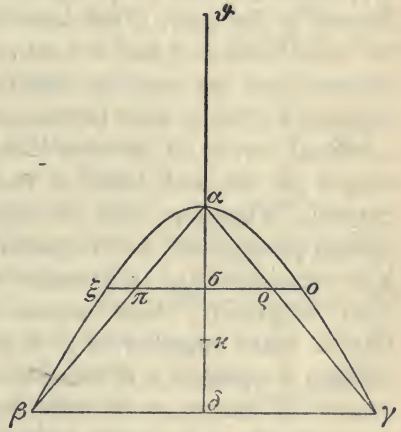

Fig. 5.

and $\xi\sigma^2 : \sigma\pi^2$ = the circle with the diameter ξo : the circle with the diameter $\pi\rho$, therefore $\theta a : a\sigma$=the circle whose diameter is ξo : the circle whose diameter is $\pi\rho$. Therefore the circle whose diameter is ξo will in its present position be in equilibrium at the point a with the circle whose diameter is $\pi\rho$ when this is so transferred to θ on the scale-beam that θ is its center of gravity. Now since σ is the center of gravity of the circle whose diameter is ξo in its present position, and θ is the center of gravity of the circle whose diameter is $\pi\rho$ if its position is changed as we have said, and inversely $\theta a : a\sigma$ = the circle with the diameter ξo : the circle with the diameter $\pi\rho$, then the circles are in equilibrium at the point a. In the same way it can be shown that if another straight line is drawn in the parabola $\| \beta\gamma$ and on this line last drawn a plane is constructed perpendicular to $a\delta$, the circle formed in the segment of the right conoid will in its present position be in equilibrium at the point a with the circle formed in the cone, if the latter is transferred and so arranged on the scale-beam at θ that θ is its center of gravity. Therefore if the segment and the cone are filled up with circles, all circles in the segment will be in their present positions in equilibrium at the point a with all circles of the cone if the latter are transferred and so arranged on the scale-beam at the point θ that θ is their center of gravity. Therefore also the segment of the right conoid in its present position will be in equilibrium at the point a with the cone if it is transferred and so arranged on the scale-beam at θ that θ is its center of gravity. Now because the center of gravity of both magnitudes taken together is a, but that of the cone alone when its position is changed is θ, then the center of gravity of the remaining magnitude lies on $a\theta$ extended towards a if $a\kappa$ is cut off in such a way that $a\theta : a\kappa$ = segment : cone. But the segment is one and one half the size of the cone, consequently $a\theta = \frac{3}{2}a\kappa$ and κ, the center of gravity of the right conoid, so divides $a\delta$ that the portion at the vertex of the segment is twice as large as the remainder.

VI.

[The center of gravity of a hemisphere is so divided on its axis] that the portion near the surface of the hemisphere is in the ratio of 5 : 3 to the remaining portion.

Let a sphere be cut by a plane through its center intersecting the surface in the circle $a\beta\gamma\delta$ [Fig. 6], $a\gamma$ and $\beta\delta$ being two diameters of the circle perpendicular to each other. Let a plane be con-

structed on $\beta\delta$ perpendicular to $\alpha\gamma$. Then imagine a cone whose base is the circle with the diameter $\beta\delta$, whose vertex is at α and its lateral boundaries are $\beta\alpha$ and $\alpha\delta$; let $\gamma\alpha$ be produced so that $\alpha\theta = \gamma\alpha$, imagine the straight line $\theta\gamma$ to be a scale-beam with its center at α and in the semi-circle $\beta\alpha\delta$ draw a straight line $\xi o \parallel \beta\delta$; let it cut the circumference of the semicircle in ξ and o, the lateral boundaries of the cone in π and ρ, and $\alpha\gamma$ in ϵ. On ξo construct a plane perpendicular to $\alpha\epsilon$; it will intersect the hemisphere in a circle with the diameter ξo, and the cone in a circle with the diameter $\pi\rho$. Now because $\alpha\gamma : \alpha\epsilon = \xi\alpha^2 : \alpha\epsilon^2$ and $\xi\alpha^2 = \alpha\epsilon^2 + \epsilon\xi^2$ and $\alpha\epsilon = \epsilon\pi$, therefore $\alpha\gamma : \alpha\epsilon = \xi\epsilon^2 + \epsilon\pi^2 : \epsilon\pi^2$. But $\xi\epsilon^2 + \epsilon\pi^2 : \epsilon\pi^2 =$ the circle with the diameter $\xi o +$ the circle with the diameter $\pi\rho$: the circle with the diameter $\pi\rho$, and $\gamma\alpha = \alpha\theta$, hence $\theta\alpha : \alpha\epsilon =$ the circle with the diameter $\xi o +$ the circle with the diameter $\pi\rho$: circle with the diameter $\pi\rho$. Therefore the two circles whose diameters are ξo and $\pi\rho$ in their present position are in equilibrium at the point α with the circle whose diameter is $\pi\rho$ if it is transferred and so arranged at θ that θ is its center of gravity. Now since the center of gravity of the two circles whose diameters are ξo and $\pi\rho$ in their present position [is the point ϵ, but of the circle whose diameter is $\pi\rho$ when its position is changed is the point θ, then $\theta\alpha : \alpha\epsilon =$ the circles whose diameters are] ξo [, $\pi\rho$: the circle whose diameter is $\pi\rho$. In the same way if another straight line in the] hemisphere $\beta\alpha\delta$ [is drawn $\parallel \beta\delta$ and a plane is constructed] perpendicular to [$\alpha\gamma$ the] two [circles produced in the cone and in the hemisphere are in their position] in equilibrium at α [with the circle which is produced in the cone] if it is transferred and arranged on the scale at θ. [Now if] the hemisphere and the cone [are filled up with circles then all circles in the] hemisphere and those [in the cone] will in their present position be in equilibrium [with all circles] in the cone, if these are transferred and so arranged on the scale-beam at θ that θ is their center of gravity; [therefore the hemisphere and cone also] are in their position [in equilibrium at the point α] with the cone if it is transferred and so arranged [on the scale-beam at θ] that θ is its center of gravity.

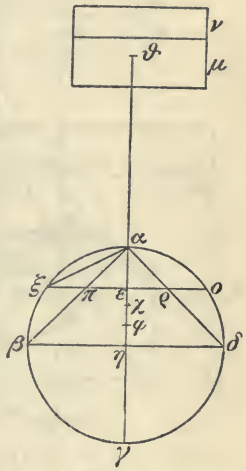

Fig. 6.

VII.

By [this method] it may also be perceived that [any segment whatever] of a sphere bears the same ratio to a cone having the same [base] and axis [that the radius of the sphere + the axis of the opposite segment : the axis of the opposite segment]..... and [Fig. 7] on $\mu\nu$ construct a plane perpendicular to $\alpha\gamma$; it will intersect the cylinder in a circle whose diameter is $\mu\nu$, the segment of the sphere in a circle whose diameter is ξo and the cone whose base is the circle on the diameter $\epsilon\zeta$ and whose vertex is at a in a circle whose diameter is $\pi\rho$. In the same way as before it may be shown that a circle whose diameter is $\mu\nu$ is in its present position in equilibrium at a with the two circles [whose diameters are ξo and $\pi\rho$ if they are so arranged on the scale-beam that θ is their center of gravity. [And the same can be proved of all corresponding circles.] Now since cylinder, cone, and spherical segment are filled up with such circles, the cylinder in its present position [will be in equilibrium at a] with the cone + the spherical segment if they are transferred and attached to the scale-beam at θ. Divide $a\eta$ at ϕ and χ so that $a\chi = \chi\eta$ and $\eta\phi = \frac{1}{3}a\phi$; then χ will be the center of gravity of the cylinder because it is the center of the axis $a\eta$. Now because the above mentioned bodies are in equilibrium at a, cylinder : cone with the diameter of its base $\epsilon\zeta$ + the spherical segment $\beta a\delta = \theta a : a\chi$. And because $\eta a = 3\eta\phi$ then $[\gamma\eta \times \eta\phi] = \frac{1}{3}a\eta \times \eta\gamma$. Therefore also $\gamma\eta \times \eta\phi = \frac{1}{3}\beta\eta^2$. .....

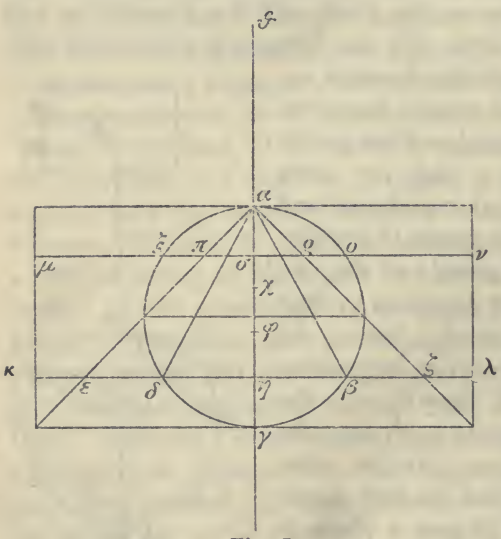

Fig 7.

VIIa.

In the same way it may be perceived that any segment of an ellipsoid cut off by a perpendicular plane, bears the same ratio to

a cone having the same base and the same axis, as half of the axis of the ellipsoid + the axis of the opposite segment bears to the axis of the opposite segment. .....

VIII.

....

produce $\alpha\gamma$ [Fig. 8] making $\alpha\theta = \alpha\gamma$ and $\gamma\xi$ = the radius of the sphere; imagine $\gamma\theta$ to be a scale-beam with a center at α, and in the plane cutting off the segment inscribe a circle with its center at η and its radius $= \alpha\eta$; on this circle construct a cone with its vertex at α and its lateral boundaries $\alpha\epsilon$ and $\alpha\zeta$. Then draw a straight line $\kappa\lambda \parallel \epsilon\zeta$; let it cut the circumference of the segment at κ and λ, the lateral boundaries of the cone $\alpha\epsilon\zeta$ at ρ and o and $\alpha\gamma$ at π. Now because $\alpha\gamma : \alpha\pi = \alpha\kappa^2 : \alpha\pi^2$ and $\kappa\alpha^2 = \alpha\pi^2 + \pi\kappa^2$ and $\alpha\pi^2 = \pi o^2$ (since also $\alpha\eta^2 = \epsilon\eta^2$), then $\gamma\alpha : \alpha\pi = \kappa\pi^2 + \pi o^2 : o\pi^2$. But $\kappa\pi^2 + \pi o^2 : \pi o^2 =$ the circle with the diameter $\kappa\lambda$ + the circle with the diameter $o\rho$: the circle with the diameter $o\rho$ and $\gamma\alpha = \alpha\theta$; therefore $\theta\alpha : \alpha\pi =$ the circle with the diameter $\kappa\lambda$ + the circle with the diameter $o\rho$: the circle with the diameter $o\rho$. Now since the circle with the diameter $\kappa\lambda$ + the circle with the diameter $o\rho$: the circle with the diameter $o\rho = \alpha\theta : \pi\alpha$, let the circle with the diameter $o\rho$ be transferred and so arranged on the scale-beam at θ that θ is its center of gravity; then $\theta\alpha : \alpha\pi =$ the circle with the diameter $\kappa\lambda$ + the circle with the diameter $o\rho$ in their present positions : the circle with the diameter $o\rho$ if it is transferred and so arranged on the scale-beam at θ that θ is its center of gravity. Therefore the circles in the segment $\beta\alpha\delta$ and in the cone $\alpha\epsilon\zeta$ are in equilibrium at α with that in the cone $\alpha\epsilon\zeta$. And in the same way all circles in the segment $\beta\alpha\delta$ and in the cone $\alpha\epsilon\zeta$ in their present positions are in equilibrium at the point α with all circles in the cone $\alpha\epsilon\zeta$ if they are transferred and so arranged on the scale-beam at θ that θ is their center of gravity; then also the spherical segment

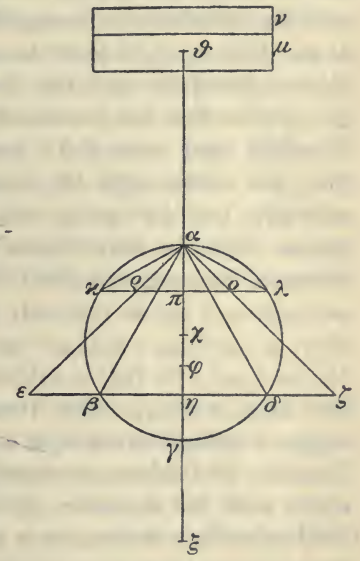

Fig. 8.

$\alpha\beta\delta$ and the cone $\alpha\epsilon\zeta$ in their present positions are in equilibrium at the point α with the cone $\epsilon\alpha\zeta$ if it is transferred and so arranged on the scale-beam at θ that θ is its center of gravity. Let the cylinder $\mu\nu$ equal the cone whose base is the circle with the diameter $\epsilon\zeta$ and whose vertex is at α and let $\alpha\eta$ be so divided at ϕ that $\alpha\eta = 4\phi\eta$; then ϕ is the center of gravity of the cone $\epsilon\alpha\zeta$ as has been previously proved. Moreover let the cylinder $\mu\nu$ be so cut by a perpendicularly intersecting plane that the cylinder μ is in equilibrium with the cone $\epsilon\alpha\zeta$. Now since the segment $\alpha\beta\delta$ + the cone $\epsilon\alpha\zeta$ in their present positions are in equilibrium at α with the cone $\epsilon\alpha\zeta$ if it is transferred and so arranged on the scale-beam at θ that θ is its center of gravity, and cylinder $\mu\nu$ = cone $\epsilon\alpha\zeta$ and the two cylinders $\mu + \nu$ are moved to θ and $\mu\nu$ is in equilibrium with both bodies, then will also the cylinder ν be in equilibrium with the segment of the sphere at the point α. And since the spherical segment $\beta\alpha\delta$: the cone whose base is the circle with the diameter $\beta\delta$, and whose vertex is at α = $\xi\eta : \eta\gamma$ (for this has previously been proved [*De sph. et cyl.* II, 2 Coroll.]) and cone $\beta\alpha\delta$: cone $\epsilon\alpha\zeta$ = the circle with the diameter $\beta\delta$: the circle with the diameter $\epsilon\zeta = \beta\eta^2 : \eta\epsilon^2$, and $\beta\eta^2 = \gamma\eta \times \eta\alpha$, $\eta\epsilon^2 = \eta\alpha^2$, and $\gamma\eta \times \eta\alpha : \eta\alpha^2 = \gamma\eta : \eta\alpha$, therefore cone $\beta\alpha\delta$: cone $\epsilon\alpha\zeta$ = $\gamma\eta : \eta\alpha$. But we have shown that cone $\beta\alpha\delta$: segment $\beta\alpha\delta = \gamma\eta : \eta\xi$, hence $\delta\iota'$ $\ddot{\iota}\sigma o\upsilon$ segment $\beta\alpha\delta$: cone $\epsilon\alpha\zeta = \xi\eta : \eta\alpha$. And because $\alpha\chi : \chi\eta = \eta\alpha + 4\eta\gamma : \alpha\eta + 2\eta\gamma$ so inversely $\eta\chi : \chi\alpha = 2\gamma\eta + \eta\alpha : 4\gamma\eta + \eta\alpha$ and by addition $\eta\alpha : \alpha\chi = 6\gamma\eta + 2\eta\alpha : \eta\alpha + 4\eta\gamma$. But $\eta\xi = \frac{1}{4}(6\eta\gamma + 2\eta\alpha)$ and $\gamma\phi = \frac{1}{4}(4\eta\gamma + \eta\alpha)$; for that is evident. Hence $\eta\alpha : \alpha\chi = \xi\eta : \gamma\phi$, consequently also $\xi\eta : \eta\alpha = \gamma\phi : \chi\alpha$. But it was also demonstrated that $\xi\eta : \eta\alpha$ = the segment whose vertex is at α and whose base is the circle with the diameter $\beta\delta$: the cone whose vertex is at α and whose base is the circle with the diameter $\epsilon\zeta$; hence segment $\beta\alpha\delta$: cone $\epsilon\alpha\zeta = \gamma\phi : \chi\alpha$. And since the cylinder μ is in equilibrium with the cone $\epsilon\alpha\zeta$ at α, and θ is the center of gravity of the cylinder while ϕ is that of the cone $\epsilon\alpha\zeta$, then cone $\epsilon\alpha\zeta$: cylinder $\mu = \theta\alpha : \alpha\phi = \gamma\alpha : \alpha\phi$. But cylinder $\mu\nu$ = cone $\epsilon\alpha\zeta$; hence by subtraction, cylinder μ : cylinder $\nu = \alpha\phi : \gamma\phi$. And cylinder $\mu\nu$ = cone $\epsilon\alpha\zeta$; hence cone $\epsilon\alpha\zeta$: cylinder $\nu = \gamma\alpha : \gamma\phi = \theta\alpha : \gamma\phi$. But it was also demonstrated that segment $\beta\alpha\delta$: cone $\epsilon\alpha\zeta = \gamma\phi : \chi\alpha$; hence $\delta\iota'$ $\ddot{\iota}\sigma o\upsilon$ segment $\beta\alpha\delta$: cylinder $\nu = \zeta\alpha : \alpha\chi$. And it was demonstrated that segment $\beta\alpha\delta$ is in equilibrium at α with the cylinder ν and θ is the center of gravity of the cylinder ν, consequently the point χ is also the center of gravity of the segment $\beta\alpha\delta$.

IX.

In a similar way it can also be perceived that the center of gravity of any segment of an ellipsoid lies on the straight line which is the axis of the segment so divided that the portion at the vertex of the segment bears the same ratio to the remaining portion as the axis of the segment +4 times the axis of the opposite segment bears to the axis of the segment + twice the axis of the opposite segment.

X.

It can also be seen by this method that [a segment of a hyperboloid] bears the same ratio to a cone having the same base and axis as the segment, that the axis of the segment + 3 times the addition to the axis bears to the axis of the segment of the hyperboloid + twice its addition [*De Conoid.* 25]; and that the center of gravity of the hyperboloid so divides the axis that the part at the vertex bears the same ratio to the rest that three times the axis + eight times the addition to the axis bears to the axis of the hyperboloid + 4 times the addition to the axis, and many other points which I will leave aside since the method has been made clear by the examples already given and only the demonstrations of the above given theorems remain to be stated.

XI.

When in a perpendicular prism with square bases a cylinder is inscribed whose bases lie in opposite squares and whose curved surface touches the four other parallelograms, and when a plane is passed through the center of the circle which is the base of the cylinder and one side of the opposite square, then the body which is cut off by this plane [from the cylinder] will be $\frac{1}{6}$ of the entire prism. This can be perceived through the present method and when it is so warranted we will pass over to the geometrical proof of it.

Imagine a perpendicular prism with square bases and a cylinder inscribed in the prism in the way we have described. Let the prism be cut through the axis by a plane perpendicular to the plane which cuts off the section of the cylinder; this will intersect the prism containing the cylinder in the parallelogram $\alpha\beta$ [Fig. 9] and the common intersecting line of the plane which cuts off the section of the cylinder and the plane lying through the axis perpendicular

to the one cutting off the section of the cylinder will be $\beta\gamma$; let the axis of the cylinder and the prism be $\gamma\delta$ which is bisected at right angles by $\epsilon\zeta$ and on $\epsilon\zeta$ let a plane be constructed perpendicular to $\gamma\delta$. This will intersect the prism in a square and the cylinder in a circle.

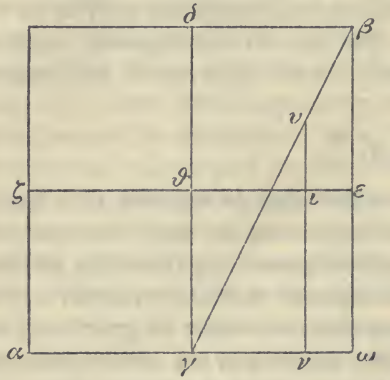

Fig. 9.

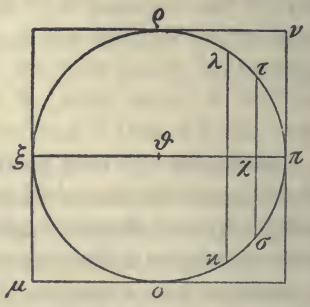

Fig. 10.

Now let the intersection of the prism be the square $\mu\nu$ [Fig. 10], that of the cylinder, the circle $\xi o\pi\rho$ and let the circle touch the sides of the square at the points ξ, o, π and ρ; let the common line of intersection of the plane cutting off the cylinder-section and that passing through $\epsilon\zeta$ perpendicular to the axis of the cylinder, be $\kappa\lambda$; this line is bisected by $\pi\theta\xi$. In the semicircle $o\pi\rho$ draw a straight line $\sigma\tau$ perpendicular to $\pi\chi$, on $\sigma\tau$ construct a plane perpendicular to $\xi\pi$ and produce it to both sides of the plane enclosing the circle $\xi o\pi\rho$; this will intersect the half-cylinder whose base is the semicircle $o\pi\rho$ and whose altitude is the axis of the prism, in a parallelogram one side of which $= \sigma\tau$ and the other = the vertical boundary of the cylinder, and it will intersect the cylinder-section likewise in a parallelogram of which one side is $\sigma\tau$ and the other $\nu\upsilon$ [Fig. 9]; and accordingly $\nu\upsilon$ will be drawn in the parallelogram $\delta\epsilon \parallel \beta\omega$ and will cut off $\epsilon\iota = \pi\chi$. Now because $\epsilon\gamma$ is a parallelogram and $\nu\iota \parallel \theta\gamma$, and $\epsilon\theta$ and $\beta\gamma$ cut the parallels, therefore $\epsilon\theta : \theta\iota = \omega\gamma : \gamma\nu = \beta\omega : \upsilon\nu$. But $\beta\omega : \upsilon\nu =$ parallelogram in the half-cylinder : parallelogram in the cylinder-section, therefore both parallelograms have the same side $\sigma\tau$; and $\epsilon\theta = \theta\pi$, $\iota\theta = \chi\theta$; and since $\pi\theta = \theta\xi$ therefore $\theta\xi : \theta\chi =$ parallelogram in half-cylinder : parallelogram in the cylinder-section. Imagine the parallelogram in the cylinder-section transferred and so brought to ξ that ξ is its center of gravity, and further imagine

$\pi\xi$ to be a scale-beam with its center at θ; then the parallelogram in the half-cylinder in its present position is in equilibrium at the point θ with the parallelogram in the cylinder-section when it is transferred and so arranged on the scale-beam at ξ that ξ is its center of gravity. And since χ is the center of gravity in the parallelogram in the half-cylinder, and ξ that of the parallelogram in the cylinder-section when its position is changed, and $\xi\theta : \theta\chi =$ the parallelogram whose center of gravity is χ : the parallelogram whose center of gravity is ξ, then the parallelogram whose center of gravity is χ will be in equilibrium at θ with the parallelogram whose center of gravity is ξ. In this way it can be proved that if another straight line is drawn in the semicircle $o\pi\rho$ perpendicular to $\pi\theta$ and on this straight line a plane is constructed perpendicular to $\pi\theta$ and is produced towards both sides of the plane in which the circle $\xi o\pi\rho$ lies, then the parallelogram formed in the half-cylinder in its present position will be in equilibrium at the point θ with the parallelogram formed in the cylinder-section if this is transferred and so arranged on the scale-beam at ξ that ξ is its center of gravity; therefore also all parallelograms in the half-cylinder in their present positions will be in equilibrium at the point θ with all parallelograms of the cylinder-section if they are transferred and attached to the scale-beam at the point ξ; consequently also the half-cylinder in its present position will be in equilibrium at the point θ with the cylinder-section if it is transferred and so arranged on the scale-beam at ξ that ξ is its center of gravity.

XII.

Let the parallelogram $\mu\nu$ be perpendicular to the axis [of the circle] ξo [$\pi\rho$] [Fig. 11]. Draw $\theta\mu$ and $\theta\eta$ and erect upon them two planes perpendicular to the plane in which the semicircle $o\pi\rho$ lies and extend these planes on both sides. The result is a prism whose base is a triangle similar to $\theta\mu\eta$ and whose altitude is equal to the axis of the cylinder, and this prism is $\frac{1}{4}$ of the entire prism which contains the cylinder. In the semicircle $o\pi\rho$ and in the square $\mu\nu$ draw two straight lines $\kappa\lambda$ and $\tau\upsilon$ at equal distances from $\pi\xi$; these will cut the circumference of the semicircle $o\pi\rho$ at the points

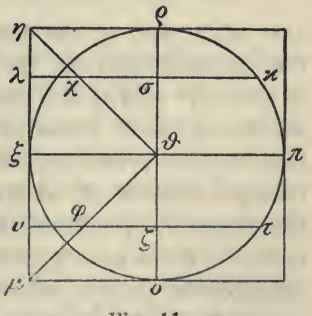

Fig. 11.

κ and τ, the diameter $o\rho$ at σ and ζ and the straight lines $\theta\eta$ and $\theta\mu$ at ϕ and χ. Upon $\kappa\lambda$ and $\tau\upsilon$ construct two planes perpendicular to $o\rho$ and extend them towards both sides of the plane in which lies the circle $\xi o\pi\rho$; they will intersect the half-cylinder whose base is the semicircle $o\pi\rho$ and whose altitude is that of the cylinder, in a parallelogram one side of which $=\kappa\sigma$ and the other = the axis of the cylinder; and they will intersect the prism $\theta\eta\mu$ likewise in a parallelogram one side of which is equal to $\lambda\chi$ and the other equal to the axis, and in the same way the half-cylinder in a parallelogram one side of which $=\tau\zeta$ and the other = the axis of the cylinder, and the prism in a parallelogram one side of which $=\upsilon\phi$ and the other = the axis of the cylinder.....

XIII.

Let the square $\alpha\beta\gamma\delta$ [Fig. 12] be the base of a perpendicular prism with square bases and let a cylinder be inscribed in the prism whose base is the circle $\epsilon\zeta\eta\theta$ which touches the sides of the parallelogram $\alpha\beta\gamma\delta$ at ϵ, ζ, η and θ. Pass a plane through its center and the side in the square opposite the square $\alpha\beta\gamma\delta$ corresponding to the side $\gamma\delta$; this will cut off from the whole prism a second prism which is ¼ the size of the whole prism and which will be bounded by three parallelograms and two opposite triangles. In the semicircle $\epsilon\zeta\eta$ describe a parabola whose origin is $\eta\epsilon$ and whose axis is $\zeta\kappa$, and in the parallelogram $\delta\eta$ draw $\mu\nu \parallel \kappa\zeta$; this will cut the circumference of the semicircle at ξ, the parabola at λ, and $\mu\nu \times \nu\lambda = \nu\zeta^2$ (for this is evident [Apollonios, *Con.* I, 11]). Therefore $\mu\nu : \nu\lambda = \kappa\eta^2 : \lambda\sigma^2$. Upon $\mu\nu$ construct a plane parallel to $\epsilon\eta$; this will intersect the prism cut off from the whole prism in a right-angled triangle one side of which is $\mu\nu$ and the other a straight line in the plane upon $\gamma\delta$ perpendicular to $\gamma\delta$ at ν and equal to the axis of the cylinder, but whose hypotenuse is in the intersecting plane. It will intersect the portion which is cut off from the cylinder by the plane passed through $\epsilon\eta$ and the side of the square opposite the side $\gamma\delta$ in a right-angled triangle one side of which is $\mu\xi$ and the other a straight line drawn in the surface of the cylinder perpendicular

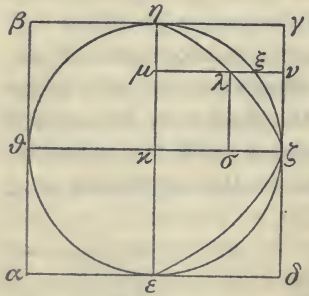

Fig. 12.

to the plane $\kappa\nu$, and the hypotenuse.....
and all the triangles in the prism : all the triangles in the cylinder-section = all the straight lines in the parallelogram $\delta\eta$: all the straight lines between the parabola and the straight line $\epsilon\eta$. And the prism consists of the triangles in the prism, the cylinder-section of those in the cylinder-section, the parallelogram $\delta\eta$ of the straight lines in the parallelogram $\delta\eta \,||\, \kappa\zeta$ and the segment of the parabola of the straight lines cut off by the parabola and the straight line $\epsilon\eta$; hence prism : cylinder-section = parallelogram $\eta\delta$: segment $\epsilon\zeta\eta$ that is bounded by the parabola and the straight line $\epsilon\eta$. But the parallelogram $\delta\eta = \frac{3}{2}$ the segment bounded by the parabola and the straight line $\epsilon\eta$ as indeed has been shown in the previously published work, hence also the prism is equal to one and one half times the cylinder-section. Therefore when the cylinder-section = 2, the prism = 3 and the whole prism containing the cylinder equals 12, because it is four times the size of the other prism; hence the cylinder-section is equal to $\frac{1}{6}$ of the prism, Q. E. D.

XIV.

[Inscribe a cylinder in] a perpendicular prism with square bases [and let it be cut by a plane passed through the center of the base of the cylinder and one side of the opposite square.] Then this plane will cut off a prism from the whole prism and a portion of the cylinder from the cylinder. It may be proved that the portion cut off from the cylinder by the plane is one-sixth of the whole prism. But first we will prove that it is possible to inscribe a solid figure in the cylinder-section and to circumscribe another composed of prisms of equal altitude and with similar triangles as bases, so that the circumscribed figure exceeds the inscribed less than any given magnitude.....

But it has been shown that the prism cut off by the inclined plane $< \frac{3}{2}$ the body inscribed in the cylinder-section. Now the prism cut off by the inclined plane : the body inscribed in the cylinder-section = parallelogram $\delta\eta$: the parallelograms which are inscribed in the segment bounded by the parabola and the straight line $\epsilon\eta$. Hence the parallelogram $\delta\eta < \frac{3}{2}$ the parallelograms in the segment bounded by the parabola and the straight line $\epsilon\eta$. But this is impossible because we have shown elsewhere that the parallelogram $\delta\eta$ is one and one half times the segment bounded by the parabola and the straight line $\epsilon\eta$, consequently is.....
not greater .....

And all prisms in the prism cut off by the inclined plane: all prisms in the figure described around the cylinder-section = all parallelograms in the parallelogram $\delta\eta$: all parallelograms in the figure which is described around the segment bounded by the parabola and the straight line $\epsilon\eta$, i. e., the prism cut off by the inclined plane : the figure described around the cylinder-section = parallelogram $\delta\eta$: the figure bounded by the parabola and the straight line $\epsilon\eta$. But the prism cut off by the inclined plane is greater than one and one half times the solid figure circumscribed around the cylinder-section .....

A COMMENTARY ON THE HEIBERG MANUSCRIPT OF ARCHIMEDES.

IF there ever was a case of appropriateness in discovery, the finding of this manuscript in the summer of 1906 was one. In the first place it was appropriate that the discovery should be made in Constantinople, since it was here that the West received its first manuscripts of the other extant works, nine in number, of the great Syracusan. It was furthermore appropriate that the discovery should be made by Professor Heiberg, *facilis princeps* among all workers in the field of editing the classics of Greek mathematics, and an indefatigable searcher of the libraries of Europe for manuscripts to aid him in perfecting his labors. And finally it was most appropriate that this work should appear at a time when the affiliation of pure and applied mathematics is becoming so generally recognized all over the world. We are sometimes led to feel, in considering isolated cases, that the great contributors of the past have worked in the field of pure mathematics alone, and the saying of Plutarch that Archimedes felt that "every kind of art connected with daily needs was ignoble and vulgar"[1] may have strengthened this feeling. It therefore assists us in properly orientating ourselves to read another treatise from the greatest mathematician of antiquity that sets clearly before us his indebtedness to the mechanical applications of his subject.

[1] Marcellus, 17.

Not the least interesting of the passages in the manuscript is the first line, the greeting to Eratosthenes. It is well known, on the testimony of Diodoros his countryman, that Archimedes studied in Alexandria, and the latter frequently makes mention of Konon of Samos whom he knew there, probably as a teacher, and to whom he was indebted for the suggestion of the spiral that bears his name. It is also related, this time by Proclos, that Eratosthenes was a contemporary of Archimedes, and if the testimony of so late a writer as Tzetzes, who lived in the twelfth century, may be taken as valid, the former was eleven years the junior of the great Sicilian. Until now, however, we have had nothing definite to show that the two were ever acquainted. The great Alexandrian savant,—poet, geographer, arithmetician,—affectionately called by the students Pentathlos, the champion in five sports,[2] selected by Ptolemy Euergetes to succeed his master, Kallimachos the poet, as head of the great Library,—this man, the most renowned of his time in Alexandria, could hardly have been a teacher of Archimedes, nor yet the fellow student of one who was so much his senior. It is more probable that they were friends in the later days when Archimedes was received as a savant rather than as a learner, and this is borne out by the statement at the close of proposition I which refers to one of his earlier works, showing that this particular treatise was a late one. This reference being to one of the two works dedicated to Dositheos of Kolonos,[3] and one of these (*De lineis spiralibus*) referring to an earlier treatise sent to Konon,[4] we are led to believe that this was one of the latest works of Archimedes and that Eratosthenes was a friend of his mature years, although

[2] His nickname of *Beta* is well known, possibly because his lecture room was number 2.

[3] We know little of his works, none of which are extant. Geminos and Ptolemy refer to certain observations made by him in 200 B. C., twelve years after the death of Archimedes. Pliny also mentions him.

[4] Τῶν ποτὶ Κόνωνα ἀπυσταλέντων θεωρημάτων.

one of long standing. The statement that the preliminary propositions were sent "some time ago" bears out this idea of a considerable duration of friendship, and the idea that more or less correspondence had resulted from this communication may be inferred by the statement that he saw, as he had previously said, that Eratosthenes was "a capable scholar and a prominent teacher of philosophy," and also that he understood "how to value a mathematical method of investigation when the opportunity offered." We have, then, new light upon the relations between these two men, the leaders among the learned of their day.

A second feature of much interest in the treatise is the intimate view that we have into the workings of the mind of the author. It must always be remembered that Archimedes was primarily a discoverer, and not primarily a compiler as were Euclid, Apollonios, and Nicomachos. Therefore to have him follow up his first communication of theorems to Eratosthenes by a statement of his mental processes in reaching his conclusions is not merely a contribution to mathematics but one to education as well. Particularly is this true in the following statement, which may well be kept in mind in the present day: "I have thought it well to analyse and lay down for you in this same book a peculiar method by means of which it will be possible for you to derive instruction as to how certain mathematical questions may be investigated by means of mechanics. And I am convinced that this is equally profitable in demonstrating a proposition itself; for much that was made evident to me through the medium of mechanics was later proved by means of geometry, because the treatment by the former method had not yet been established by way of a demonstration. For of course it is easier to establish a proof if one has in this way previously obtained a conception of the questions, than for him to seek it without such a preliminary notion. . . . Indeed I assume that some one among the

investigators of to-day or in the future will discover by the method here set forth still other propositions which have not yet occurred to us." Perhaps in all the history of mathematics no such prophetic truth was ever put into words. It would almost seem as if Archimedes must have seen as in a vision the methods of Galileo, Cavalieri, Pascal, Newton, and many of the other great makers of the mathematics of the Renaissance and the present time.

The first proposition concerns the quadrature of the parabola, a subject treated at length in one of his earlier communications to Dositheos.[5] He gives a digest of the treatment, but with the warning that the proof is not complete, as it is in his special work upon the subject. He has, in fact, summarized propositions VII-XVII of his communication to Dositheos, omitting the geometric treatment of propositions XVIII-XXIV. One thing that he does not state, here or in any of his works, is where the idea of center of gravity[6] started. It was certainly a common notion in his day, for he often uses it without defining it. It appears in Euclid's[7] time, but how much earlier we cannot as yet say.

Proposition II states no new fact. Essentially it means that if a sphere, cylinder, and cone (always circular) have the same radius, r, and the altitude of the cone is r and that of the cylinder $2r$, then the volumes will be as $4 : 1 : 6$, which is true, since they are respectively $\frac{4}{3}\pi r^3$, $\frac{1}{3}\pi r^3$, and $2\pi r^3$. The interesting thing, however, is the method pursued, the derivation of geometric truths from principles of mechanics. There is, too, in every sentence, a little suggestion of Cavalieri, an anticipation by nearly two thousand years of the work of the greatest immediate precursor of Newton. And the geometric imagination that Archi-

[5] Τετραγωνισμὸς παραβολῆς.

[6] Κέντρα βαρῶν, for "barycentric" is a very old term.

[7] At any rate in the anonymous fragment *De levi et ponderoso,* sometimes attributed to him.

medes shows in the last sentence is also noteworthy as one of the interesting features of this work: "After I had thus perceived that a sphere is four times as large as the cone... it occurred to me that the surface of a sphere is four times as great as its largest circle, in which I proceeded from the idea that just as a circle is equal to a triangle whose base is the periphery of the circle, and whose altitude is equal to its radius, so a sphere is equal to a cone whose base is the same as the surface of the sphere and whose altitude is equal to the radius of the sphere." As a bit of generalization this throws a good deal of light on the workings of Archimedes's mind.

In proposition III he considers the volume of a spheroid, which he had already treated more fully in one of his letters to Dositheos,[8] and which contains nothing new from a mathematical standpoint. Indeed it is the method rather than the conclusion that is interesting in such of the subsequent propositions as relate to mensuration. Proposition V deals with the center of gravity of a segment of a conoid, and proposition VI with the center of gravity of a hemisphere, thus carrying into solid geometry the work of Archimedes on the equilibrium of planes and on their centers of gravity.[9] The general method is that already known in the treatise mentioned, and this is followed through proposition X.

Proposition XI is the interesting case of a segment of a right cylinder cut off by a plane through the center of the lower base and tangent to the upper one. He shows this to equal one-sixth of the square prism that circumscribes the cylinder. This is well known to us through the formula $v = 2r^2h/3$, the volume of the prism being $4r^2h$, and requires a knowledge of the center of gravity of the cylindric section in question. Archimedes is, so far as we

[8] Περὶ κωνοειδέων καὶ σφαιροειδέων.

[9] Ἐπιπέδων ἰσορροπιῶν ἢ κέντρα βαρῶν ἐπιπέδων.

know, the first to state this result, and he obtains it by his usual method of the skilful balancing of sections. There are several lacunae in the demonstration, but enough of it remains to show the ingenuity of the general plan. The culminating interest from the mathematical standpoint lies in proposition XIII, where Archimedes reduces the whole question to that of the quadrature of the parabola. He shows that a fourth of the circumscribed prism is to the segment of the cylinder as the semi-base of the prism is to the parabola inscribed in the semi-base; that is, that $\frac{1}{4}p : v = \frac{1}{2}b : (\frac{2}{3} \cdot \frac{1}{2}b)$, whence $v = \frac{1}{6}p$. Proposition XIV is incomplete, but it is the conclusion of the two preceding propositions.

In general, therefore, the greatest value of the work lies in the following:

1. It throws light upon the hitherto only suspected relations of Archimedes and Eratosthenes.

2. It shows the working of the mind of Archimedes in the discovery of mathematical truths, showing that he often obtained his results by intuition or even by measurement, rather than by an analytic form of reasoning, verifying these results later by strict analysis.

3. It expresses definitely the fact that Archimedes was the discoverer of those properties relating to the sphere and cylinder that have been attributed to him and that are given in his other works without a definite statement of their authorship.

4. It shows that Archimedes was the first to state the volume of the cylinder segment mentioned, and it gives an interesting description of the mechanical method by which he arrived at his result.

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THE CHOICE OF FACTS.[1]

TOLSTOY somewhere explains why "science for its own sake" is in his eyes an absurd conception. We cannot know *all* facts, since their number is practically infinite. It is necessary to choose; then we may let this choice depend on the pure caprice of our curiosity. Would it not be better to let ourselves be guided by utility, by our practical and above all by our moral needs? Have we nothing better to do than count the number of lady-bugs on our planet?

It is clear the word "utility" has not for him the sense men of affairs give it, and following them most of our contemporaries. Little cares he for industrial applications, for the marvels of electricity or of automobilism, which he regards rather as obstacles to moral progress; utility for him is solely what can make man better.

For my part, it need scarce be said, I could never be content with either the one or the other ideal; I would not wish either a grasping and mean plutocracy nor a goody and mediocre democracy which is occupied solely in turning the other cheek, where sages would dwell without curiosity, and, shunning excess, would not die of disease to be sure, but would certainly perish of ennui. But that is a matter of taste and is not what I wish to discuss.

The question nevertheless remains and should fix our

[1] Translated from the French by G. B. Halsted.

attention; if our choice can only be determined by caprice or by immediate utility, there can be no science for its own sake, and consequently no science. But is that true? That a choice must be made is incontestable; however active we may be, facts move faster than we, and we cannot catch up with them. While the scientist discovers one fact, milliards on milliards are taking place in a cubic millimeter of his body. To try to comprehend nature in science would mean to put the whole into the part.

But scientists believe that there is a hierarchy of facts and that a judicious choice may be made among them. They are right, since otherwise there would be no science, and science exists. One need only open his eyes to see that the conquests of industry which have enriched so many practical men would never have seen the light, if these practical men alone had existed and if they had not been preceded by unselfish devotees who died poor, who never thought of utility, and yet had a guide far other than caprice.

As Mach says, these devotees have spared their successors the trouble of thinking. Those who might have worked solely in view of an immediate application would have left nothing behind them, and, in the face of a new need, all must have been begun over again. Now most men do not love to think, and this is perhaps fortunate when instinct guides them, for most often, when they pursue an aim which is immediate and ever the same, instinct guides them better than reason would direct a pure intelligence. But instinct is routine, and if thought did not fecundate it, it would make no more progress in man than in the bee or ant. It is needful then to think for those who do not like to think, and as these are numerous, it is needful that each of our thoughts be useful as often as possible, and this is why a law will be the more precious according as it is the more general.

This shows us how we should choose: the most interesting facts are those which may serve many times; these are the facts which have a chance of coming up again. We have been so fortunate as to be born in a world where there are such. Suppose that instead of 60 chemical elements there were 60 milliards of them, that they were not, some common the others rare, but that they were uniformly distributed. Then every time we picked up a new pebble there would be a great probability of its being formed of some unknown substance. All that we knew of other pebbles would be worthless for it. Before each new object we should be as the new-born babe; like it we could only obey our caprices or our needs. In such a world there would be no science; perhaps thought and even life would be impossible, since evolution could not develop there the preservational instincts. Happily it is not so; like all god fortune to which we are accustomed, this is not appreciated at its true worth. The biologist would be just as perplexed if he had only individuals and no species, and if heredity did not make sons resemble their fathers.

Which, then, are the facts likely to reappear? First of all, they are the simple facts. It is clear that in a complex fact a thousand circumstances are united by chance, and that only a chance still much less probable could reunite them anew. But are there any simple facts? And if there are, how recognize them? What assurance is there that a thing we think simple does not hide a dreadful complexity? All we can say is that we ought to prefer the facts which *seem* simple to those where our crude eye discerns unlike elements. And then we have one of two things: either this simplicity is real, or else the elements are so intimately mingled as not to be distinguishable. In the first case there is chance of our meeting anew this same simple fact, either in all its purity or entering as an ele-

ment in a complex manifold. In the second case this intimate mixture has likewise more chances of recurring than a heterogeneous assemblage. Chance knows how to mix, it does not know how to disentangle, and in order to construct with multiple elements a well-ordered edifice in which something is distinguishable, it is necessary to make it expressly. The facts which appear simple, even if they are not so, will therefore be more easily revived by chance. This it is which justifies the method instinctively adopted by the scientist, and what justifies it still better, perhaps, is that oft-recurring facts appear to us simple, precisely because we are used to them.

But where is the simple fact? Scientists have been seeking it in the two extremes, in the infinitely great and in the infinitely small. The astronomer has found it because the distances of the stars are immense, so great that each of them appears but as a point, so great that the qualitative differences are effaced, and because a point is simpler than a body which has form and qualities. The physicist, on the other hand, has sought the elementary phenomenon in fictitiously cutting up bodies into infinitesimal cubes, because the conditions of the problem, which undergo slow and continuous variation in passing from one point of the body to another, may be regarded as constant in the interior of each of these little cubes. In the same way the biologist has been instinctively led to regard the cell as more interesting than the whole animal, and the outcome has shown his wisdom, since cells belonging to the most diverse organisms are more alike, for one who can recognize their resemblances, than are these organisms themselves.

The sociologist is more embarrassed; the elements which for him are men, are too unlike, too variable, too capricious, in a word, too complex themselves. Besides, history never begins over again; how then choose the interesting fact, which is the one that begins again? Method

is precisely the choice of facts; it is needful then to be occupied first with creating a method, and many have been imagined, since none imposes itself. Each thesis in sociology proposes a new method, which however the new doctor is careful not to apply, so that sociology is the science with the most methods and fewest results.

Therefore it seems best to begin with the regular facts; but after the rule is well established, after it is beyond all doubt, the facts in full conformity with it are ere long without interest since they no longer teach us anything new. It is then the exception which becomes important. We cease to seek resemblances; we devote ourselves above all to differences, and among the differences are chosen first the most accentuated, not only because they are the most striking, but because they will be the most instructive.

I will endeavor to render this thought more plain by a simple example. Let us assume that some one wishes to determine a curve which he does by observing some of its points. The practical man who concerns himself only with immediate utility would observe only the points he might need for some special purpose. These points would be badly distributed on the curve; they would be crowded in certain regions, rare in others, so that it would be impossible to join them by a continuous line, and they would be unavailable for other applications. The scientist will proceed differently; as he wishes to study the curve for itself, he will distribute regularly the points to be observed, and when enough are known he will join them by a regular line and then he will have the entire curve. But to accomplish this, how does he proceed? If he has determined an extreme point of the curve, he does not stay near this extremity, but goes first to the other end; after the two extremities the most instructive point will be the center and so on.

So when a rule is established we should first seek the cases where this rule has the greatest chance of failing. Thence, among other reasons, come the interest of astronomic facts and the interest of the geologic past. By going very far away in space or very far away in time, we may find our usual rules entirely overturned, and these grand overturnings aid us the better to see or to understand the little changes which may happen nearer to us, in the little corner of the world where we are called to live and act. We shall know this corner better for having traveled in distant countries with which we have nothing to do.

But what we ought to aim at is less the ascertainment of resemblances and differences than the recognition of likenesses hidden under apparent divergences. Particular rules seem at first discordant, but looking more closely we see that in general they resemble each other; different as to matter, they are alike as to form, as to the order of their parts. When we look at them in this way, we shall see them enlarge and tend to embrace everything. And this it is which makes the value of certain facts which come to complete an assemblage and to show that it is the faithful image of other known assemblages.

I will not insist further, but these few words suffice to show that the scientist does not choose at random the facts he observes. He does not, as Tolstoy says, count the lady-bugs, because, however interesting lady-bugs may be, their number is subject to capricious variations. He seeks to condense much experience and much thought into one slender volume; and that is why a little book on physics contains so many past experiences and a thousand times as many possible experiences whose result is known beforehand.

But we have as yet looked at only one side of the question. The scientist does not study nature because it is useful; he studies it because he delights in it, and he de-

lights in it because it is beautiful. If nature were not beautiful, it would not be worth knowing, and if nature were not worth knowing, life would not be worth living. Of course I do not speak here of that beauty which strikes the senses, the beauty of qualities and appearances; not that I undervalue such beauty, far from it, but it has nothing to do with science. I mean that profounder beauty which comes from the harmonious order of the parts and which a pure intelligence can grasp. This it is which gives body, a structure so to speak, to the iridescent appearances which flatter our senses, and without this support, the beauty of these fugitive dreams would be only imperfect, because it would be vague and always fleeting. On the contrary, intellectual beauty is sufficient unto itself, and it is for its sake, more perhaps than for the future good of humanity, that the scientist devotes himself to long and difficult labors.

It is, therefore, the quest of this special beauty, the sense of the harmony of the cosmos, which makes us choose the facts most fitting to contribute to this harmony, just as the artist chooses from among the features of his model those which perfect the picture and give it character and life. And we need not fear that this instinctive and unavowed prepossession will turn the scientist aside from the search for the true. One may dream a harmonious world, but how far will the real world leave it behind! The greatest artists that ever lived, the Greeks, made a heaven of their own; how shabby it is beside the true heaven, ours!

And it is because simplicity, because grandeur, is beautiful, that we preferably seek simple facts, sublime facts; that we delight now to follow the majestic course of the stars, now to examine with the microscope that prodigious littleness which is also a grandeur, now to seek in geologic

time the traces of a past which attracts us because it is far away.

We see too that the longing for the beautiful leads us to the same choice as the longing for the useful. And so it is that this economy of thought, this economy of effort, which is, according to Mach, the constant tendency of science, is at the same time a source of beauty and a practical advantage. The edifices that we admire are those where the architect has known how to proportion the means to the end, where the columns seem to carry gaily, without effort, the weight placed upon them, like the gracious caryatids of the Erechtheum.

Whence comes this concordance? Is it simply that the things which seem beautiful to us are those which best adapt themselves to our intelligence, and that consequently they are at the same time the implement this intelligence knows best how to use? Or is there here a play of evolution and natural selection? Have the peoples whose ideal most conformed to their highest interest exterminated the others and taken their place? All pursued their ideals without reference to consequences, but while this quest led some to destruction, to others it gave empire. One is tempted to believe it. If the Greeks triumphed over the barbarians and if Europe, heir of Greek thought, dominates the world, it is because the savages loved loud colors and the clamorous tones of the drum which occupied only their senses, while the Greeks loved the intellectual beauty which hides beneath sensuous beauty, and that this intellectual beauty it is which makes intelligence sure and strong.

Doubtless such a triumph would horrify Tolstoy, and he would not like to acknowledge that it might be truly useful. But this disinterested quest of the true for its own beauty is sane also and able to make man better. I know well that there are mistakes, that the thinker does

not always draw thence the serenity he should find therein, and even that there are scientists of bad character. Must we, therefore, abandon science and study only morals? What! Do you think the moralists themselves are irreproachable when they come down from their pedestals?

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MUSIC IN THE OLD TESTAMENT.[1]

LECTURE GIVEN FOR THE BENEFIT OF THE HOME FOR AGED MUSIC TEACHERS AT BRESLAU, FEBRUARY 9, 1906.

MUSIC belongs to the inalienable rights of man. It is the effort to make one's self intelligible to his fellow men by means of the stimulation of sounds of all kinds. Music exists wherever men are found upon the earth and everywhere they show a genuine refinement in the discovery of means by which to originate sounds. There is hardly anything which can not be brought into use for its purposes.

We do not intend to lose ourselves here in speculation upon the psychological reasons for this demoniac impulse; we will be content simply to establish the fact and will not enter into it with regard to humanity in general, but only in so far as the ancient people of Israel is concerned. Even with relation to the Old Testament we will limit ourselves to what the Old Testament itself can tell us about music and musical things.

Many passages have proved very puzzling to Bible readers. For instance when we read in the heading of Psalm lxxx, "To the chief Musician upon Shoshannim-Eduth, A Psalm of Asaph"; or in the heading of Ps. lx., "To the chief Musician upon Shushan-eduth, Michtam of David, to teach"; or in the heading of Ps. lvi, "To the chief Musician upon Jonath-elem-rechokim, Michtam of

[1] Translated from Professor Cornill's manuscript by Lydia Gillingham Robinson, and revised by the author.

David"; or when Psalms viii, lxxxi, and lxxxiv, bear the inscription, "To the chief Musician upon Gittith"; or the three, xxxix, lxii, and lxxvii "to Jeduthun"; we may certainly assume that we have an explanation for these hieroglyphics in considering that they possess some kind of a musical character.[2] Accordingly it will be our task to gather together and to sift out the information given by the Old Testament itself upon music and musical matters and then to see whether we can unite and combine these scattered and isolated features into one comprehensive picture or at least into a comparatively clear idea. It is only scattered and isolated features which the Old Testament offers us and not very much of them nor very abundantly. Not perhaps because music had played a subordinate and inconspicuous part in the life of ancient Israel,—on the contrary they must have been a people of an unusually musical temperament whose daily nourishment was song and sound. On this point the Old Testament itself leaves little room for doubt.

Everywhere and at all times were song and music to be found in Ancient Israel. Every festival occasion, every climax of public or private life was celebrated with music and song. Just as Homer called singing and string music "the consecration of the meal,"[3] so also in ancient Israel no ceremonial meal could be thought of without its accompaniment of either vocal or instrumental music. Marriage ceremonies took place amid festive choruses with music and dancing, and at the bier of the dead sounded the

[2] Luther in his translation makes an attempt to translate these "hieroglyphics," but the above quoted meaningless combinations of letters from the King James version hardly convey less significance to the reader of to-day than his sentences: *"Ein Psalm Assaphs von den Spanrosen, vorzusingen"* (lxxx); *"Ein gülden Kleinod Davids, vorzusingen, von einem güldenen Rosenspan zu lehren"* (lx); etc. Professor Cornill considers the English translation "To the chief Musician" as preferable to Luther's *vorzusingen.* The Polychrome Bible translates this word "For the Liturgy," and interprets the succeeding clauses as "the catch-word of an older song, to the tune whereof this Psalm was to be sung." Tr.

[3] *ἀναθήματα δαιτός.*

wail of dirge and flute. The sheep were sheared and the vintage gathered to songs of joy and dancing and tambourine playing. The same was true in public life. The election of a king or his coronation or betrothal were celebrated with music; the victorious warriors and generals were met upon their return home by choruses of matrons and maidens with dance and song. So Miriam spoke from among the chorus of women who after the successful passage through the Red Sea went out "with timbrels and with dances" (Ex. xv. 20); in the same way too, David was received by matrons and maidens after his successful battle with the Philistines (1 Sam. xviii. 6); and upon this custom is founded the frightful tragedy of the story of Jephthah, whose daughter hastened in the joy of her heart to offer greeting and praise to her victorious father, only to be met by death as the fulfilment of his vow (Judges xi).

How great a place music occupied in the worship of ancient Israel is universally known. The entire Psalter is nothing else than a collection of religious songs which were sung in the temple worship where the priests with their trumpets and the choruses of music-making Levites stand before the eye of our imagination. Especially by typical expressions do we learn what a significance music had for the life of the Israelitish nation. There is in Hebrew a saying which characterizes what we would call being "common talk," "the object of gossip," "on everybody's tongue," in such a way as to indicate ditties sung in ridicule. The Hebrew expression *neginah*[4] means "string music," being derived from the word *nagan*,[5] "to beat," "to touch," with special reference to instruments, as in striking the chords. In Psalm lxix. 12, this word *neginah* is used in a passage which literally reads: "I am the lute song of drunkards." The Polychrome Bible translates the passage: "I am the

[4] נגינה [5] נגן

subject of wine bibbers' ballads." In the same sense the word is used in Job xxx. 9, with reference to the frightful fate that had befallen him: "And now am I their song, yea I am their byword." And in Lamentations we find (iii. 14, 63), "I was a derision to all my people; and their song all the day. . . . Behold their sitting down, and their rising up; I am their music." Here the word translated "song" and "music" is the same in both instances. When Job's fortune changes to evil he says (xxx. 31), "My harp also is turned to mourning, and my organ into the voice of them that weep." The dreadful desolation of Jerusalem after its destruction is described in Lamentations with the words: "The elders have ceased from the gate, the young men from their music" (v. 14).

Ancient Israel must have been recognized among outside nations as well, as a particularly musical people whose accomplishments in the art comprised a definite profession. For this view we have two extremely characteristic sources of evidence, one from Assyrian monuments and one from the Old Testament. In his account of the unsuccessful siege of Jerusalem by the Assyrians in the year 701 B. C. Sanherib tells us, according to the translation of Hugo Winckler, that Hezekiah, king of Judah, besides all kinds of valuable articles sent also his daughters and the women of his palace together with men and women singers to the great king at Nineveh, while in the touching Psalm cxxxvii we learn that the Babylonian tyrant demanded songs of the Jewish exiles, to cheer them up: "Sing to us your beautiful songs of Zion."

Jewish tradition has given expression to the fact that music belongs to the earliest benefits and gifts of the culture of mankind by establishing Jubal as the inventor of music and father of musicians as early as the seventh generation after the creation (Gen. iv. 21). An important influence on the human heart was ascribed to music and it

was employed to drive away the evil spirit of melancholy when David played before the sick King Saul (1 Sam. xvi. 23). It was also used as a spiritual stimulus by which to acquire prophetic inspiration. In Samuel's time companies of prophets traversed the land to the music of psalter and harp (1 Sam. x. 5), and so the Prophet Elisha to whom the Kings Jehoshaphat and Jehoram applied for an oracle from God, sent for a lute player, saying (2 Kings iii. 15): "But now bring me a minstrel. And it came to pass, when the minstrel played, that the hand of the Lord came upon him."

An art to which such a powerful influence was attributed and to whose most famous masters the greatest king of Israel belonged, must have been zealously practised, and we will now undertake to gain some idea of the cultivation of music in ancient Israel. To this end it will be most useful if we will begin our investigation with what the Old Testament says about musical instruments, of course with express exception of the book of Daniel which in its third chapter mentions a large number of instruments, using their Greek names as naturalized words;[6] for these prove absolutely nothing with regard to ancient Hebrew music which at present is our only consideration.

We may with equal propriety exclude singing from our investigation. Song is such an especially instinctive and spontaneous expression of the human soul that its presence is established *a priori*. In this connection the question might be raised with regard to the construction of the tone system, but this can not be answered without knowledge of the instruments employed. Only I will not neglect to mention that as early as in the time of David professional male and female singers provided music during mealtime. David wished to take with him to Jerusalem as a reward for fidelity the faithful old Barzillai who had

[6] σῦριγξ, σαμβύκη, κίθαρις, ψαλτήριον, συμφωνία.

PLATE I.

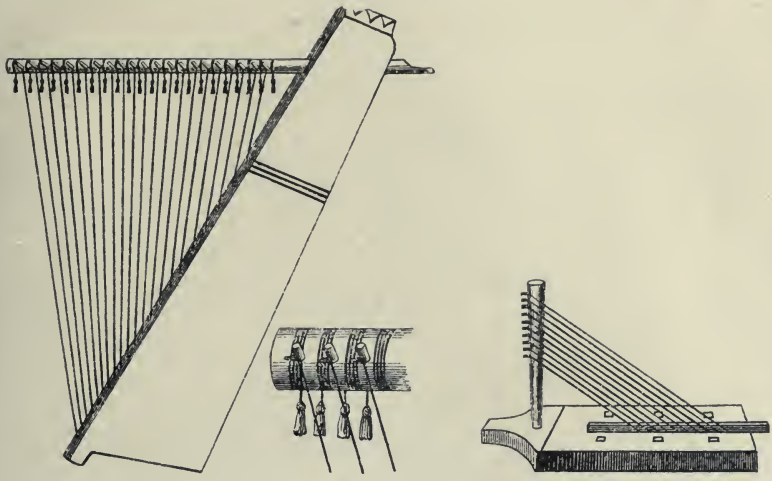

FIG. 1. EGYPTIAN HARPS.

FIG. 2. EGYPTIAN HARP CARRIED IN PROCESSION.

FIG. 3. EGYPTIAN PICTURE OF A BEDOUIN WITH KINNOR.

FIG. 4. AN ASSYRIAN CYMBALIST.

FIG. 5. ASSYRIAN LUTE PLAYERS.

protected him at the time of Absalom's rebellion. There he would be the daily guest of the king; but Barzillai answered (2 Sam. xix. 35), "I am this day fourscore years old; and can I discern between good and evil? Can thy servant taste what I eat or what I drink? Can I hear any more the voice of singing men and singing women? Wherefore then should thy servant be yet a burden unto my lord the king?" Solomon, the Preacher, also delighted in "men singers and women singers and the delights of the sons of men, as musical instruments and that of all sorts" (Eccl. ii. 8).

* * *

Musical instruments are usually divided into three classes, percussive instruments, stringed instruments, and wind instruments, and we shall also follow this division. Of these three classes the percussive instruments are the most primitive. They can not be said to possess any properly articulated tones but sounds only, and their single artistic element is rhythm, which however is certainly the foundation and essential characteristic of music according to the witty utterance of Hans von Bülow, "In the beginning was the rhythm."

Among percussive instruments the one most frequently mentioned is the timbrel or tabret (in Hebrew *toph*[7]) which corresponds exactly to our tambourine. Often they were richly ornamented so that they were frequently referred to as decorations. In one of the most splendid passages of the prophet Jeremiah, we read: "Again I will build thee, and thou shalt be built, O virgin of Israel; thou shalt again be adorned with thy tabrets, and shalt go forth in the dances of them that make merry" (Jer. xxxi. 4). This passage is particularly characteristic of the nature of the tabret in two respects; first, it usually appears in the hands of women (in all passages where tabret players are ex-

[7] תֹּף

pressly mentioned they are matrons and maidens); and secondly it almost always appears in connection with the dance, as being swung in the dance and marking its rhythm. We can suppose it to have been undoubtedly played by men only in connection with the music of the companies of prophets in Samuel's time, for if we read that these prophets came down from the sacred high place with a psaltery, and a tabret, and a pipe, and a harp before them (1 Sam. x. 5), we would hardly think of the musicians who accompanied these wild men and played the tabrets before them, as women.

The second percussive instrument is the familiar cymbal, which comes next to our mind in thinking of the music of the Old Testament. With regard to the nature and character of this instrument we can gather all that is essential from the Bible itself. In the first place the cymbal must have been constructed of brass, for in the familiar passage, 1 Cor. xiii. 1, the Apostle Paul writes according to the Greek text, "Though I speak with the tongues of men and of angels, and have not charity I am become as sounding brass, or a tinkling cymbal." The Hebrew root *tsalal*[8] from which both words for cymbal are derived, means "clatter," to give forth a sharp penetrating sound; and the word most frequently used, *metsiltayim*[9] is in the dual form which is never used in the Hebrew language in its purely grammatical sense, but only in the logical sense of things which occur in nature only in pairs. Now since a penetrating and loud tone is repeatedly attributed to the cymbals we may consider them as two metal plates to be struck together (Fig. 4); that is to say, they are the instruments which we know as cymbals and which are known in German as *Becken* and in Italian as *piatti*, and which are most familiar to us in military music in combination with a bass drum.

[8] צלל [9] מצלתים

FIG. 6. SISTRUM AND OTHER ANCIENT INSTRUMENTS.
(British Museum.)

FIG. 7. RELIEF FROM SENDSCHIRLI IN NORTHERN SYRIA.

Two other percussive instruments are mentioned of which one is still doubtful. The one which is undoubtedly certain, *mena'an'im*[10] (2 Sam. vi. 5) evidently comes from the root *nua'*,[11] "to shake" and corresponds exactly with the Greek sistrum[12] which consists of metal crossbars upon which hang metal rings that are made to produce their tones by shaking (Fig. 6). Accordingly in current language it is the Turkish bell-tree, the *cinelli,* with which we are familiar also through German military music.

Then too an instrument called the *shalish*[13] is mentioned in the hands of women together with the tabret at the triumphant reception of David upon his return from the conquest of the giant Goliath (1 Sam. xviii. 6). The word *shalish* being derived from the same root as *shalosh,* the number "three," we have been accustomed to identify it with our modern triangle, but it is a question whether we are justified in so doing. With this instrument we have exhausted the number of percussive instruments mentioned in the Old Testament.

It might perhaps be more logical for us to follow the percussive instruments at once with the wind instruments, inasmuch as they are the most primitive next to the percussive instruments because horns of animals and reeds are nature's own gifts to men, while strings made from catgut are a purely artificial product. But as far as ancient Israel was concerned the stringed instruments were by far the most important. I will remind my readers once more of the proverbial application of the word string-music above mentioned.

Accordingly I will next consider the stringed instruments, of which the Old Testament mentions two, the *kinnor,*[14] and *nebel.*[15] That both were composed of strings drawn across wood (Fig. 8) may be proved, in so far as it needs proof, by the fact that according to 1 Kings x. 12,

[10] מנענעים [11] נוע [12] σεῖστρον [13] שלישׁ [14] כנור [15] נבל

Solomon ordered certain instruments of this class intended for the temple service to be made out of sandal wood, which he had obtained during his famous visits to Ophir. Of these two instruments the kinnor is the most important, but I will begin with the nebel because we have the more definite tradition with regard to it. When Jerome tells us that the nebel, whose name became *nabla*[16] and *nablium* in Greek and Latin, possessed the form of a Greek Delta Δ, we thus have the triangular pointed harp indicated as plainly as possible (Fig. 1). The only objection that can be brought against this view, namely that we repeatedly meet this instrument in the hands of dancers and pilgrims, is not sound. In representations of Ancient Egypt, we also have harps so small that they could easily be carried (Fig. 2), and the best commentaries have lately shown us Assyrian representations where pointed harps with the points at the top and fastened with a band were likewise carried in the hands of dancing processions (Fig. 9). If the points of these Assyrian harps were regularly at the top, this will explain to us better St. Jerome's comparison with the Greek Delta which of course has the point at the top.

Especially noteworthy among others is an Assyrian representation (Fig. 15) in which three prisoners are being led into exile by an Assyrian king, and all three are playing four-stringed harps on the march, but the harps are so turned that the broad side is on top. It is very possible that these figures may represent captive Israelites.

There must have been several varieties of nebel (e. g., Fig. 12). A harp of ten strings (dekachord) is repeatedly mentioned[17] in clear distinction from the usual ones which accordingly must have had fewer than ten strings, perhaps four as in that Assyrian sketch. An instrument of six strings is the interpretation of many exegetists of the

[16] *νάβλα*. [17] Ps. xxxiii. 2; xcii. 4; cvliv. 9.

FIG. 8. ASSYRIAN HARPISTS.
(British Museum.)

FIG. 9. ASSYRIAN PROCESSION OF MUSICIANS.

word *shushan*[18] which Luther translates by *Rosen* in the headings to Psalms xlv, lx, lxix and lxxx. When we read in Luther's Bible in the headings to Psalms vi and xii "to be rendered on eight strings,"[19] this is hardly an accurate translation of a musical term with which we shall occupy ourselves later.

By far the most important stringed instrument on the other hand, is the kinnor. Its invention is ascribed to Jubal, and we meet with it on every hand in the most varied occasions. The exiles hung them on the willows by the waters of Babylon (Ps. cxxxvii. 2) and according to a passage in the book of Isaiah, which to be sure comes from a much later date, probably the Greek period, they are used by harlots for the public allurement of men (Is. xxiii. 16).

For us the kinnor has indeed a conspicuous interest and a particular significance in that it was the instrument of King David, by which the son of Jesse subdued the melancholy of King Saul, and which he played when dancing before the ark. We are particularly fortunate in possessing an authentic copy of this instrument on an Egyptian monument. On the tomb of Chnumhotep, the Prince of Middle Egypt at Beni Hassan in the time of Pharaoh Usurtesen II of the 12th dynasty, which can not be placed later than 2300 B. C., a procession of Semitic nomads is represented which Chnumhotep is leading into the presence of Pharaoh in order to obtain the royal permission for a dwelling place in Egypt. In this procession a man who comes immediately behind the women and children is carrying by a leather thong an instrument which we can not fail to recognize as the kinnor (Fig. 3, cf. also Fig. 5). It is a board with four rounded corners and with a sounding hole in the upper part over which eight strings are

[18] שושן

[19] The Polychrome Bible here understands "in the eighth [mode]" or key. The authorized version again resorts to a transcription of the Hebrew, "On Neginoth upon Sheminith." Dr. Cornill's view is given on pages 257 f. Tr.

stretched. The man picks the strings with the fingers of his left hand while he strikes them with a so-called plectrum,[20] a small stick held in his right hand. That the Israelites also played their stringed instruments partly with their fingers and partly by means of such a plectrum we might conclude from the two characteristically different expressions for playing on strings: *zamar,*[21] "to pluck," and *nagan,*[22] "to strike." All antiquity was unacquainted with the use of bows to produce sound from stringed instruments of any kind.

Hence the kinnor may first of all be compared to our zither, except that it apparently had no hollow space underneath and no special sounding board. The stringed instruments as they are represented in countless different varieties on Jewish coins (Figs. 13 and 14) do not correspond either with the nebel or the kinnor but much more closely resemble the Greek lyre[23] and therefore have little value with reference to the Old Testament.

We might also consider the *gittith* a stringed instrument where the headings to Ps. viii, lxxxi, and lxxxiv, read "upon Gittith."[24] But it is very doubtful whether the word *gittith*[25] translates a musical instrument and not rather a particular kind of song or melody. In either case it will be better not to confuse the old Israelitish temple orchestra with the gittith.

We have still to consider the wind instruments. One of these whose invention is likewise ascribed to Jubal is called the *'ugab.*[26] Besides in Gen. iv. 21, it is mentioned twice in the book of Job, and once in Ps. cl, in which all instruments and everything that hath breath are sum-

[20] πλῆκτρον [21] זמר [22] נגן [23] λύρα

[24] The Polychrome Bible comments: "We do not know whether *Gittith* means 'belonging to the city of Gath,' which probably had been destroyed before the Babylonian Exile, or 'belonging to a wine-press' (= Song for the Vintage?), or whether it denotes a mode or key, or a musical instrument." Tr.

[25] גתית

[26] עוגב. It is translated in the authorized version by "organ," but in Ps. cl. 4, in the margin, as "pipe." Tr.

PLATE IV.

FIG. 10. ASSYRIAN HARP AND FLUTE PLAYERS.

FIG. 11. ASSYRIAN QUARTETTE.

FIG. 12. AN ANCIENT ELEVEN-STRINGED HARP OF BABYLON.

moned to give praise and thanksgiving to God (Ps. cl. 4; Job xxi. 12; xxx. 31). This *'ugab* is most probably the same as the bag-pipe which is of course a very primitive and widely spread instrument familiar to us as the national instrument of the Scotch, and best known in continental Europe as the *pifferari* of Italy. It has been customary to translate *'ugab* by "shawm"; Luther calls it "pipes" (*Pfeifen*).

The most important reed instrument, the flute, we find referred to as *khalil,*[27] only in five passages: with the thundering music of the prophets (1 Sam. x. 5); at the proclamation of Solomon as the successor of David (1 Kings i. 40); twice in the book of Isaiah, in connection with the dinner music of the rich gluttons and winebibbers at Jerusalem (v. 12), and also "when one goeth with the pipe to come into the mountain of the Lord" (xxx. 29); and finally once in the book of Jeremiah as the instrument of mourning and lamentation, where we read (xlviii. 36), "Therefore mine heart shall sound for Moab like pipes." In this connection we are reminded to some extent of the awakening of Jairus's little daughter. When Jesus reached the house of mourning he found there before him flute players and weeping women[28] (Matt. ix. 23; Mark v. 38).

Of the construction of these flutes the Old Testament tells us nothing and leaves nothing to be inferred, and yet we imagine that the khalil was not a transverse flute but probably a sort of beaked flute, thus corresponding much more closely to our clarinet. We find the transverse flutes only in very isolated cases on Egyptian monuments, while on the other hand we find the beaked flutes regularly in an overwhelming majority with the Assyrians, and indeed often composed of two tubes as was the common form among the Greeks (Fig. 10). But nearer than this we

[27] חלִיל. Translated in the authorized version by "pipe." Tr.

[28] The English version speaks simply of "minstrels and the people making a noise," without translating the kind of instrument used. Tr.

can not affirm anything with regard to their use in ancient Israel.

We find animal horns mentioned twice among wind instruments, as ram's horns, once indeed in connection with the theophany of Sinai (Exodus xix. 13) and once at the capture of Jericho (Josh. vi. 5). The term "horn," *qeren,*[29] for a musical instrument comes under Greek influence again in the book of Daniel. On the other hand in Old Testament times only the two forms *shofar*[30] and *hatsotserah*[31] were in common use. On the triumphal arch of Titus (Figs. 16 and 17) and on two Jewish coins (Fig. 18) we have esthetic representations of the hatsotserah which was peculiarly the instrument of worship and was blown by the priests. According to Num. x, two hatsotseroth (the word always occurs in the plural in the Hebrew with one exception) were to be fashioned out of silver by skilful handiwork and there the priests made use of them to call together the people and to announce the feasts and new moons. That these instruments in the ancient temple were indeed of silver we learn also from an incidental notice in 2 Kings xii. 13, in the reign of King Joash. According to many pictures they are rather long and slender and perfectly straight, widening gradually in front into a bell mouth, hence the very instruments which the pictures of ancient art used to place in the hands of angels, and which may best be compared with the so-called clarion of ancient music, a kind of clarinet made of metal.

The wind instrument which is second in importance, the *shofar,* still plays a part in the worship of the synagogue, but in the Old Testament, as far as religious use is concerned it is far behind the hatsotserah. According to Jerome the horn of the shofar is bent backward in contrast to the straight horn of the hatsotserah. It is especially the instrument for sounding signals of alarm, for

[29] קרן [30] שופר [31] חצוצרה

FIG. 13. LYRES ON ANCIENT COINS.
(After Madden.)

FIG. 14. LUTES ON ANCIENT COINS
(After Madden.)

FIG. 15. SEMITIC CAPTIVES PLAYING ON FOUR-STRINGED HARPS.

which purpose it was widely used. According to law this trumpet was to be sounded on the day of atonement every forty-ninth year, the year of jubilee (Lev. xxv. 9). There is a noteworthy passage in the book of Isaiah where it says that on that day at the sounding of the great trumpet (*shofar*) all the Jews scattered and exiled throughout the whole world shall come back to worship in the holy mount at Jerusalem (Is. xxvii. 13); and this eschatological and apocalyptical passage has also become significant with regard to the New Testament, for from it the Apostle Paul takes the trump of the last judgment by whose sound the dead will arise according to 1 Cor. xv. 52, and 1 Thess. iv. 16. (Cf. also Matt. xxiv. 31.) According to the prophet Zechariah the Lord of Sabaoth himself shall blow the trumpet (*shofar*) at the last judgment (Zech. ix. 14).

Whether the ancient Israelites really played melodies or signals in the natural tones of the bugle or the signal trumpet we do not know. We have only two characteristically different expressions for the blowing on the shofar and hatsotserah, viz., "blow"[32] on the instruments and "howl"[33] on them. By the first word is meant to make a noise by short sharp blasts and by the last, by long drawn out ringing notes. This is what we learn from the Old Testament about musical instruments of ancient Israel and their use.

* * *

The character of the music of ancient Israel we must consider in general as merry and gay, almost boisterous, so that it seemed advisable to refrain from music in the presence of men who were ill-tempered or moody. In the Proverbs of Solomon xxv. 20, we have the expressive simile, "as vinegar upon nitre so is he that singeth songs to an heavy heart." Music served most conspicuously and was of first importance in the joys of life as, for instance,

[32] תקע taka' [33] הריע heri'a

dinner music, dance music, and feast music, so that the prophet Jeremiah speaks of it as the voice of mirth and the voice of gladness (Jer. vii. 34; xvi. 9; xxv. 10; xxxiii. 11). Even ritual music seems to have borne a worldly character in ancient Israel, so that through the prophet Amos, God addresses the nation in words of wrath: "Take thou away from me the noise of thy songs; for I will not hear the melody of thy viols" (v. 23). Amos uses here exactly the same strong expression with which Ezekiel (xxiii. 42) describes the singing of abandoned women in Bacchanalian orgies, and (xxvi. 13) the sound of harps in the luxurious commercial center of Tyre.

Since in all ancient reports men and women singers are named together, it is therefore most probable that women took part in the ritual service of ancient Israel. A doubtful passage in Amos should according to all probability be translated "Then will the women singers in the temple howl" (Amos viii. 3), and this circumstance may have especially aroused the anger of the puritanical and untaught herdsman of Tekoa. But that Amos may have had a justifiable foundation for his repugnance to the singing of women became clear to me when in the spring of 1905 I attended the International Congress of Orientalists at Algiers as official delegate of the Prussian Government and had an opportunity for the first time to hear modern Arabian music. On the second evening of the Congress a lecture was offered to us on "La musique arabe" illustrated by concrete examples. At the left of the lecturer was a group of male, and on the right a group of female musicians, which at his signal performed their corresponding parts. But since no provision was made for reserved seats, then or at any other session of the congress, there ensued a battle of elbows in open competition, and the hall was much too small for the number of the members of the Congress, which seemed to be the chronic

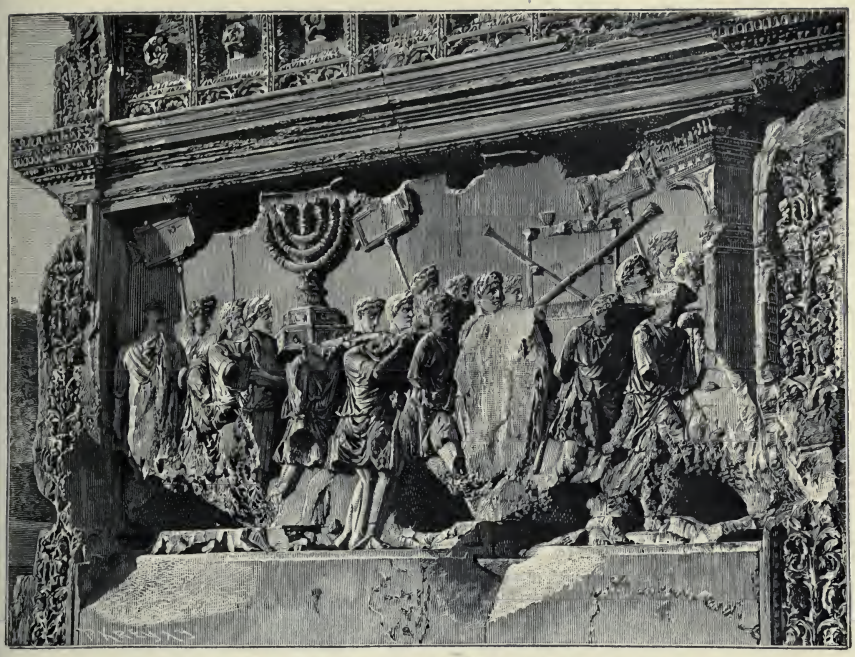

FIG. 16. RELIEF ON THE ARCH OF TITUS.
Showing the Trumpets (*hatsotseroth*) taken from Herod's Temple.

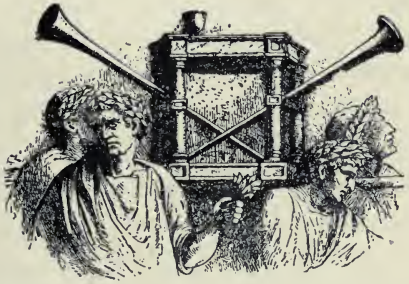

FIG. 17. DETAIL FROM FIG. 16.

FIG. 18. TRUMPETS ON ANCIENT JEWISH COIN.
(After Madden.)

state of things in Algiers. Hence with my particular gift always and everywhere to get the worst place, I was pressed against the farthest wall, where it was necessary in this instance to stand for two good hours wedged in a fearfully crowded corner, and so, greatly to my sorrow, many occurrences escaped me.

Still the impression of the whole was decidedly striking, presumably because of the difference between male and female singing. Never did both groups perform together in a mixed chorus (just as Orientals do not recognize a dance between men and women) but each group sang by itself. The song and music of the men was very solemn and dignified, in slow time without a distinct rhythm or melodious cadence, but in a sort of recitative (*Sprechgesang*) which is now in vogue in the latest music. The music of the women was very different. In their performance all was fire and life. They sang in a pronounced melody with sharply accentuated rhythm in a passionate *tempo,* and they treated the instruments upon which they accompanied their singing with incredible expression. Not only throat and fingers but the whole person in all its members was engaged in making music. If we may imagine the women who sang in ancient Israel entirely or approximately like their modern feminine counterparts, it is easy to understand how a man like the prophet Amos at the outbreak of such a band in the temple at Bethel might have received the impression of a "variety show" in church. And another thing occurred to me in connection with the songs of those women, that according to the language of music they are all composed in minor, and indeed only in the two scales of D Minor and A Minor, which with their characteristic intervals in the case of the so-called "church" keys have been named Doric and Aeolic,—so then we see that just as a deep meaning often lies in the games of children, the familiar German pun that the trum-

pets of the Israelites before the walls of Jericho were blown in the key of D Minor (D *moll*) because they *demol*ished those walls, was not made entirely out of whole cloth.

This brings us quite naturally to the question whether or not the music of ancient Israel had a tone system and a definite scale. When even on the earliest Egyptian and Assyrian monuments the pointed harps have strings of constantly diminishing length and the flutes have sound-holes where the players manipulate their fingers, it is absolutely necessary for us to investigate this question, for these pictorial illustrations testify to definite tones of varying pitch and in that case a fixed scale must have previously existed.

To be sure I must at the outset abandon one means of determining this scale, and that is accent. Besides the vowel signs our Hebrew texts have also so-called accents which perform a threefold function; first as accent in its proper signification to indicate the stress of voice, then as punctuation marks, and finally as musical notation. This accent also denotes a definite *melisma,* or a definite cadence according to which the emphasized word in the intoned discourse of the synagogue (the so-called *niggun*[34]) was to be recited. The learned bishop of the Moravian Brethren and counsellor of the Brandenburg consistory, Daniel Ernst Jablonski, in the preface to the Berlin edition of 1699 of the Old Testament made under his patronage, undertook to rewrite these accents according to the custom of the *Sefardim,* (that is, of the Spanish-Portuguese Jews) in modern notes and has thus rewritten in notes one longer coherent passage in Genesis (xlviii. 15, 16), which I sometimes have occasion to sing to my students at college. But this *niggun,* as evidence has lately been found to prove, is of Christian origin, an imitation of the so-

[34] נגון

FIG. 19. ASSUR-NASIR-PAL GREETED BY MUSICIANS ON HIS RETURN FROM A BULL HUNT.
(In the British Museum)

called *neumes,*[35] used in the Greco-Syrian communities of the Orient in reciting the Gospels, and accordingly has been handed down from the church to the synagogue, and so for ancient Israel and its music has no meaning;—at least directly, for the Church was essentially under Greek influence, and Greek music must not be identified with that of ancient Israel, nor must the latter be constructed according to the former. The only trace, although an uncertain one, in the Old Testament itself appears in the expression which I have however already mentioned, and which Luther translates "on eight strings" (*auf acht Saiten*). But in Hebrew the word is *sheminith,*[36] meaning "ordinal number" so that we must not translate "on eight" but "on (or after) the *eighth.*" Accordingly a musician can hardly do otherwise than insert this "eighth" in the familiar *octave,* the foundation of our tone system, and assume that the ancient Israelites also had a scale of seven intervals so that the eighth becomes the same scale but placed an octave higher. And this interpretation has also a support in the Old Testament. Our principal source for the music of ancient Israel is the Biblical book of Chronicles which has evidently been written by a specialist, a Levitical musician of the temple, who offers us a complete series of technical statements with regard to ancient musical culture. So we read in one of the most important passages (1 Chron. xv. 20, 21) that a circle of temple musicians played upon the *nebel,* the harp, *al alamoth,*[37] literally translated "after the manner of maidens," and another on the *kinnor,* the lute, *al hashsheminith,*[38] literally, "after the eighth." By the designation "after the manner of maidens" can only be meant the high clear voices of women, that is to say soprano, and then it is of course natural to see in the "eighth" the deeper voices of the men an octave lower. If this combination is correct, and it is at least very promising, we

[35] *νεύματα.* [36] שמינית [37] עַל עֲלָמוֹת [38] עַל הַשְּׁמִינִית

see clearly proven in it the existence of a scale of seven intervals, even if we know nothing about the particular intervals and their relation to each other.

Another characteristic of the music of ancient Israel is that it does not take into account pure instrumental music, the so-called absolute music, but on the contrary regards instruments simply as accompaniment for singing. The usage of the language is significant with regard to this point. The Hebrew calls instruments *kele hashshir,*[39] "instruments of song" and calls musicians simply "singers"; for it has long been observed that in the passages which treat of singers in the proper sense a particular form of the participle is always found, the so-called *Kal,*[40] while another participial form of the same root, the so-called *Polel,*[41] designates musicians in general. Accordingly Israel considers the essential nature and the foundation of all music to be in song, in *Melos.* And what an ingenious instinct, what an artistic delicacy of feeling is given utterance in this designation! The end pursued by modern music is to compress the living human voice into a dead instrument, while the great musicians of all times have considered it their task rather to let the instruments sing, to put a living human soul into the dead wood, metal, or sheepgut. Such was the case with the people of Israel.

Likewise the music of ancient Israel knew nothing of polyphony which is an abomination to Orientals in general. And to be sure must not polyphony be designated as a two-edged sword? For counterpoint is commonly understood to come in exactly at the point when the musician lacks melody and conception. And what is even the most artistic polyphony of a Richard Strauss or a Max Reger compared to the heavenly melody of the larghetto in Mozart's clarinet quintet! What the chronicler considers an ideal performance is stated in a characteristic passage:

[39] כלי השיר [40] שר [41] משורר

"It came even to pass, as the trumpeters and singers were as one, to make one sound to be heard in praising and thanking the Lord" (2 Chron. v. 13). Hence a single powerful *unisono* is the ideal of the music of ancient Israel.

The passage of Chronicles above quoted, leads us to the dedication of Solomon's temple. And since Israel is the nation of religion, and as we are moreover best informed by the chronicler just about temple music, we shall in conclusion make an attempt to sketch a picture of the temple music of ancient Israel.

With regard to the orchestra of the temple, the lack of wooden wind-instruments is noteworthy. Even the flute is mentioned only once in connection with a procession of pilgrims (Is. xxx. 29),[42] but never in connection with the worship proper.

Since the trumpets were reserved for the use of the priests in giving signals at certain definite places in the ritual, the temple orchestra consisted only of stringed instruments, harps and lutes, so that the music of the temple is repeatedly called simply "stringed music," *neginah*.[43]

And to these stringed instruments cymbals also may be added. These three instruments, cymbals, harps and lutes are always mentioned in this order as played by the Levites.

The Levites were again divided into three groups after David's three singing masters, Asaph, Heman and Jeduthun (sometimes Ethan). Since these three names always occur in the same order we are led to combine the corresponding systems and to give to Asaph the cymbals, to Heman the harp, and to Jeduthun the lute; and for the first and third of these combinations we have corroborative

[42] The Polychrome Bible reads "Joy of heart like his who sets forth to the flute to go to the mountain of Yahveh," but in the authorized version the instrument is called "pipe" and not "flute." Tr.

[43] נגינה. In the headings of Psalms iv, vi, liv, lv, lxi, lxvii, and lxxvi. Cf. also Is. xxxviii. 20; and Hab. iii. 19.

quotations: Once in 1 Chron. xvi. 5, it is expressly mentioned as a function of Asaph, that he "made a sound with cymbals"; and again in 1 Chron. xxv. 3, Jeduthun is mentioned as he "who prophesied with a lute."[44] This shows us how to understand the heading of the three Psalms xxxix, lxii, and lxxvii, "To Jeduthun."[45] These evidently are to be accompanied only by Jeduthun with the lute, and this agrees with the grave and somber character of those three psalms.

This indicates that even in the most primitive beginnings there was an art of instrumentation which took into consideration the timbre of the instruments, and as a modern analogy we might point out certain priestly passages in the Magic Flute. The wonderful effect of these passages rests on the fact that Mozart neglected the common usage (which would have combined two violins with a tenor and bass viol in the string quartette) and left out the violins, assigning the quartette exclusively to the viols. But just here in this division of instruments is a point expressly handed down by tradition, which must appear strange to us: to Asaph who is always mentioned in the first place and apparently acts as the first orchestra leader, is assigned only the ringing brass of the cymbals. But these cymbals apparently served the purpose of a baton in the hand of a modern orchestra leader marking the rhythm with their sharp penetrating tone and so holding together the whole. The trumpets of the priests were to serve the people as "a memorial before God" (Num. x. 9-10). Hence they are in some measure a knocking at the door of God, and apparently have the same function as the bell at a Catholic

[44] The English version translates this also as "harp." Tr.

[45] Wellhausen in his Notes to the Polychrome Edition of *The Book of Psalms* thus explains the word which he translates as "for (or from) Jeduthun." "*Jeduthun*, like *Korah* and *Asaph*, was the name of a post-Exilic guild of temple-musicians....Hence the Psalms may have been attributed to them originally in just the same way that many German hymns are attributed to the Moravian Brethren: they belonged originally to a private collection, and subsequently found their way into the common hymn-book." Tr.

mass in giving the people the signal to fall upon their knees (2 Chron. xxix. 27-28). The supposition has been expressed that the puzzling *selah* in the Psalms, which undoubtedly had a musical liturgical sense and indicated an interruption of the singing by instruments, marked the places where the priests blew their trumpets—an assumption which can be neither proved nor disproved.

What now is the case with regard to the temple song which of course was the singing of psalms? We learn from Chronicles that the later usage removed women's voices from the service and recognized only Levitical singers. In a remarkable passage (Psalms lxviii. 25) which describes a procession of the second temple the women still come into prominence as "damsels playing with timbrels" but ordinarily only male singers and lute players are mentioned. But if Psalm xlvi, for instance, were sung according to its inscription "after the manner of maidens,"[46] we must assume that the men sang in a falsetto, just as not so very long ago when women's voices were in the same manner excluded from the service of the Evangelical Church, falsetto was regularly practised and belonged to the art of Church music.

With regard to the melodies to which the Psalms were sung, here again, as it seems, we have the same process as in the German Church songs. When we find ascribed to the Psalms as melodies the words "To the Tune of the Winepress,"[47] Psalms viii, lxxxi, lxxxiv; "To the Tune of Lilies,"[48] Psalms xlv, lx, lxix, lxxx; "To the Tune of The Hind of the Dawn,"[49] Psalm xxii; "To the Tune of The Dove of Far-off Islands,"[50] Psalm lvi; or according

[46] This part of the heading to Psalm xlvi, Luther translates, *"Von der Jugend, vorzusingen"*; the authorized English version gives "a song upon Alamoth"; and the Polychrome Bible says "with Elamite instruments." Tr.

[47] על הגתית if derived from גת winepress. [48] על שושנים

[49] על אילת השחר

[50] על יונת אלם רחקים, the אלם being regarded as an error in writing אים.

to the somewhat doubtful interpretation, Ps. v, "To the Tune of A Swarm of Bees,"[51] we can not doubt that they originally were secular melodies, folk-songs which found admittance into the worship of the people.

With regard to the arrangement of the temple orchestra the chronicler is again able to give us information: the singing Levites stood at the east end of the bronze altar of burnt sacrifice (2 Chron. v. 12) opposite the priests who sounded the trumpets (2 Chron. vii. 6); that is to say to the west of them. This statement to be sure involves difficulties since the whole temple was orientated from west to east so that if the Levites stood before the altar they must have obstructed the entrance to its steps and the priests were entirely concealed behind it. But we must not on this account doubt the definite statement of so competent an authority as the chronicler.

Of a musical liturgical service in the ancient temple we have two vivid descriptions: one from the chronicler and one from Jesus Sirach. The chronicler gives us the following description of a Passover in the first year of the reign of King Hezekiah (2 Chron. xxix. 26-30):

"And the Levites stood with the instruments of David, and the priests with the trumpets.

And Hezekiah commanded to offer the burnt offering upon the altar. And when the burnt offering began, the song of the Lord began also with the trumpets, and with the instruments ordained by David king of Israel.

"And all the congregation worshipped, and the singers sang, and the trumpeters sounded: and all this continued until the burnt offering was finished.

"And when they had made an end of offering, the king and all that were present with him bowed themselves, and worshipped.

"Moreover Hezekiah the king and the princes com-

[51] אל הנחילות.

manded the Levites to sing praise unto the Lord with the words of David, and of Asaph the seer. And they sang praises with gladness, and they bowed their heads and worshipped."

And Jesus Sirach says in describing the installation of Simon, a contemporary, as high priest, (Ecclesiasticus l. 15-21):

"He stretched out his hand to the cup, and poured of the blood of the grape, he poured out at the foot of the altar a sweetsmelling savour unto the most high King of all.

"Then shouted the sons of Aaron, and sounded the silver trumpets, and made a great noise to be heard, for a remembrance before the most High.

"Then all the people together hasted, and fell down to the earth upon their faces to worship their Lord God Almighty, the most High.

"The singers also sang praises with their voices, with great variety of sounds was there made sweet melody.

"And the people besought the Lord, the most High, by prayer before him that is merciful, till the solemnity of the Lord was ended, and they had finished the service.

"Then he went down, and lifted up his hands over the whole congregation of the children of Israel, to give the blessing of the Lord with his lips, and to rejoice in his name.

"And they bowed themselves down to worship the second time, that they might receive a blessing from the most High."

Here we see art inserted organically in the whole of the service; music too, like the swallow, had found a nest on the altar of the Lord of Hosts (Psalm lxxxiv, 3).

From such descriptions we comprehend the enthusiastic love and devotion of the Israelite for his temple where everything that was beautiful in his eyes was consecrated and illumined by religion, where he "might behold the

beautiful worship of the Lord," as Luther translates Ps. xxvii. 4, incorrectly to be sure, but most comfortingly;[52] and music has contributed the richest share in making this "beautiful worship of the Lord."

Both the secular and temple music of ancient Israel have long since died out in silence. Not one tone has remained alive, not one note of her melodies do we hear, but not in vain did it resound in days of old. Without temple music there would be no temple song; without temple song, no psalms. The psalms belong to the most precious treasures among the spiritual possessions of mankind; these we owe to the music of ancient Israel, and in them the temple music of ancient Israel continues to live to-day and will endure for all time.

CARL HEINRICH CORNILL.

BRESLAU, GERMANY.

[52] The authorized version has simply "the beauty of the Lord." Tr.

SOME CURRENT BELIEFS IN THE LIGHT OF HERACLEITUS'S DOCTRINE.

THE "sage" of Ephesus "flourished," we are told, in the sixty-ninth Olympiad, five hundred years before Christ. But the fallacies he then attacked are still commonly held and taught; for his argument is seldom studied and little understood. Heracleitus himself was oppressed with a sense of the novelty of his teaching, and by the difficulty of rendering it in terms of speech and thought then current. His message, therefore, is set in metaphor, and needs reinterpretation for each succeeding age; so that men still come upon his meaning as upon hidden gold.

> "Uttering things solemn and unadorned, he reaches over a thousand years with his voice, because of the god in him."

A. Let us first consider his attitude towards materialism. Just as we say that energy and even the amount of energy persist, while kinetic energy becomes potential, and potential energy becomes kinetic; so Anaximenes had taught that something he called ether persists, while it is alternately condensed and rarefied, to form all the phenomena of life. Heracleitus argues that we can not find anything which thus persists.

> "All things change; nothing abides."

The life of one thing is the death of another. Of that

energy which is said to persist unchanged in amount, no account can be given, nor can any reason be advanced for supposing that there is such a "something, I know not what." As Mach has said, all that we know is that in many cases kinetic energy which has been expended, or potential energy that has ceased to exist, may be *recovered*;—as where a ball is thrown into the air, where rain is lifted to the mountain tops, where chemical elements or magnetized particles are sundered, where heat and mechanical energy are converted into electrical "stress," and *vice versa*. It is mere metaphor to say that the energy *persists,* for we can not assign to energy any meaning which is common to kinetic and to potential energy, except the *possibility* of reversing the change. In other words it is not the *thing,* energy, but the *order,* the law of reversibility, which persists.

Therefore, from the never ending flux of things, Heracleitus directs our attention to the order, which he conceives to be "the same in all things"; which "no one of gods or men has made."

B. But his argument is fatal to a view that has been adopted by a large part of the Christian Church, that this unchanging order is one day to take the place of the present flux and strife of opposites in the world we know. The order exists now in the strife and must be found there. A world of peace is a world of death.

> "Homer was wrong in saying 'would that strife might perish from among gods and men!' He did not know that he was praying for the destruction of the universe; for if his prayer were heard all things would pass away." "War is the father of all and the king of all."

C. A view still more popular among us receives from Heracleitus some deadly blows. Evolution and progress

and betterment seem to many essential, if the world is to have meaning. Heracleitus shows that for the universe, at least, progress is a superficial aspect. For every movement and development seems to await a day of reversal,—of degeneration. The law of compensation is world-wide. Movement is not continuous in any direction, but oscillates around some fixed measure. The life of man and of the earth, the solar system and the bi-polar drift of the stars seem to await a day when their present tendencies will be reversed. And if this is so, then how superficial is that progress which, after all, is but an approach to the day when the return movement will begin.

And it must be noted that all progress implies a standard of preference. But, "for the gods," all things that are, are good, and all standards of preference are based upon the partial outlook of the individual.

> "Men themselves have made a law unto themselves, not knowing what they made it about; but the gods have ordered the nature of all things. Now the arrangements which men have made are never constant, neither when they are right nor when they are wrong; but all the arrangements which the gods have made are always right, both when they are right and when they are wrong. So great is the difference."

D. But the pessimism which a late tradition has assigned him receives in fact from Heracleitus a splendid refutation. All the negations we have thus far considered, —of fixity in things, of an ultimate peace, of genuine progress, refer, he says, in the nature of the case, to a restricted point of view, which unfortunately has always prevailed among men. Ignorance and passion confine us each one in a world of our own, which is related to the real world, the common world, much as the land of dreams is related to that world of waking life, which all men in

some measure share. The wise man alone is fully awake, and, looking at the world without prejudice, he sees, not merely a world of good and evil, and a constant flux of particular things, but rather a single, splendid, flaming life, "an everliving fire," in which fixed, eternal measures prevail.

To him the strife of the world is not mere confusion, but the opposition of forces which, through their tension, stretch the chords of life to an infinite variety of tones. These, when touched by the spirit of contemplation, sound to the ear of wisdom like a harmony of unequaled beauty.

The path towards wisdom would seem, then, to be defined in a comparatively simple fashion. To know the life of the world man must cherish in himself, also, a similar life, not hoping to attain the passionless light of the gods, but preserving in his soul the balance appropriate to it, between the control of reason and the satisfaction of desire. He will participate in the conflicts of life, and enter fully into their zest and glory. But he will look for his real satisfaction, not in the outcome of the conflict, but in the perception of the nature of the conflict. Thus the politician, while contending valiantly, will have every minute his prize and pleasure, in noting throughout the strife the operation of the laws of political life, of party government, and of human nature. Wisdom, therefore, is to be viewed not so much as an accumulation, but as insight, momentarily renewed. Thus the wise man is ever poor,—"in spirit,"—for his wealth never stays with him, but comes and goes each instant. He ever hungers and thirsts for righteousness, and is ever filled. In this way his *is* the kingdom of heaven.

This I take to be the teaching of Heracleitus.

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DAVID HUME'S NATURAL HISTORY OF RELIGION.

THE great historical interest attaching to *Natural History of Religion** is due to its being the origin of the modern science of religion. Considering the non-existence of any previous work and the material at disposal—very limited compared to that at hand nowadays—one cannot help admiring Hume's lucidity and precision in laying down those questions of principle still treated by the present science of religion. Not the less amazing is his development of religion in its main features. It has taken more than a century before this development has met with imitations perhaps equal to Hume's old work, a fact which imparts to it a value far beyond the historical one.

The philosophy of religion is generally divided in three parts: the metaphysical, criticising the theoretical validity

* Hume's *Natural History of Religion*, which was written about 1751 and published 1757, is printed in Green and Grose's Standard edition of Hume's works and in the old editions of his essays, which are now only to be had at secondhand. The need of a cheap edition of Hume's essays has given rise to a most objectionable undertaking, Ward, Lock & Bowden (afterwards Routledge & Sons) having brought out an edition, the anonymous publisher of which omits sentences of vital importance—no doubt on account of a certain bigoted tendency. The result is a corruption of Hume's opinion of so audacious a nature as to be almost unequalled in modern times. In order to counteract this abominable falsification and to give Hume's ingenious work a wider circulation than its present one, Mr. John W. Robertson has arranged a separate edition at a price of one shilling. This edition, perfectly correct, with an excellent preface (A. and H. Bradlaugh Bonner) makes the public in England and all the world over indebted to him. Wishing to draw attention to this meritorious little edition I shall also endeavor to show the significance of Hume's work, a significance which only of late has been fully conceived. In this way I want to give a clue which will make the apprehension easier; without such a clue it is often somewhat difficult to catch the principal ideas of the work, partly veiled by additions commanded by time and circumstances.

of religious notions; the ethical, treating the value of religion in behalf of the individual and the race; and the psychological historical, examining the origin and development of religious conceptions.

It is this last, the proper science of religion, of which Hume has laid the foundation in the present work. But a criticism of the religious notions must precede an examination depending on the fundamental idea that the religious notions are only to be explained through psychology and history. The work of Hume's which originated the modern science of religion as its principal point of view implies a spiritual development in the history of human thought. By another work *Dialogues Concerning Natural Religion* (written in 1751, but not published till 1779, three years after Hume's death) Hume finished the critical examination, returning the last question of science in reply to the question of the theoretical validity of religious notions. Besides being the founder of the proper science of religion, Hume became the accomplisher of the critical philosophy of religion, the latter quality determining the former. In the history of religious problems he is the great focus concentrating all the rays, his contribution in this domain proving him a pioneer still more than his examinations concerning metaphysics and ethics—examinations which are far more appreciated.

The great development in the history of English intellectual science which Hume's thoughts rested upon and brought to an end, is generally comprised under the name of English deism. The criticism of the popular notion of God, hidden under the new name "deism," originated in Greece like most other pioneering thoughts. Xenophanes, the founder of the Eleatic school, was the first known person entitled to the name of deist. He was the originator as Hume was the accomplisher. He started the inquiry into religion in a purely psychological way. The deism of

recent time refers to antiquity. The rupture with the inherited range of ideas indicated by deism in the philosophy of the Renaissance, originated in the thoughts of Plato, Aristotle and the Stoics. The first pioneers are Cusanus (*De pace seu concordia fidei,* 1453), Ficinus (*De religione christiana,* 1474), Montaigne (*Essays,* 1580), and especially Bodin, who in 1593 wrote the *Colloquium heptaplomeres,* a religious philosophical work which, however, became of no great consequence, as it appeared only in a few manuscript copies circulating exclusively in the literary world. Even if Bodin is the actual founder of deism, it was the English philosophy that had to prepare the way from a historical point of view. The English deism was initiated by Herbert of Cherbury (1581-1648) as the doctrine of "natural religion." It was then generally believed that one could refer to a "law of nature," certain unchangeable principles forming the immovable basis of any judicial system. In like manner Herbert of Cherbury was of the opinion that all religions rest on five axioms, which in their pure state form the historical basis of the later, misrepresented popular religions. This quintessence of religion tends to prove the existence of a God best worshiped by piety, and the fact of a future life, administering reward and wrath, and in a mere psychological way Herbert of Cherbury founded the five fundamental dogmas on natural instinct (*De veritate,* 1624, *De religione gentilium,* 1645). By his arguments for the existence of God, Descartes (1596-1650) tried to give the "natural religion" a rational basis (*Meditationes,* 1641). The same aim appears in Locke (1632-1704), who by definite examples wanted to fasten the "natural religion" trying at the same time to bring it in closer connection with the dogmas of Christianity (*Reasonableness of Christianity,* 1695). This tendency transforms "natural religion" into Locke's rationalism, continued by Clarke (1675-1729),

Wollaston (1659-1724), and Toland (1670-1722) in his first work (*Christianity not Mysterious,* 1696). The close connection which Locke wished to establish between natural and revealed religion, was again loosened by the genuine deists in the 18th century. The protagonists are Toland (chiefly by *Pantheisticon,* 1720), Shaftesbury (1671-1713), Collins (1676-1729), Tindal (1656-1733), Chubb (1679-1742), Bolingbroke (1662-1751), and Morgan (?-1743). All of them decidedly maintained that the moral principle, being independent of the positive religions, is the true basis of any religion, assertions which made them confine true religion in a very few doctrines, i. e., natural religion was again severed from Christianity, opposing it in a more conscious way than before. Generally the arguments for natural religion were adhered to, and in some places the need of a historical view of religion was manifest. This tendency appears with Morgan, but most obviously with Conyers Middleton (1683-1750) in his *Letter from Rome* (1729), but Hume and Gibbon (1737-97) were the first authors who made it more than mere attempts.

In *Dialogues Concerning Natural Religion* Hume criticises the prevailing arguments for the existence of God, first answering the cosmological and ontological ones. The main attack is turned against the argument from the adequacy of the world, in refuting which Hume gets an opportunity to give an ingenious anticipation of Darwin's theory (Parts V and VIII). The work is formed as a dialogue between three persons, an orthodox, only serving the others as a pawn on the chess-board, a representative of English deism, and finally Philo, a skeptic whose argumentation occupies the greater part of the work. Hume's preference for presenting his critical philosophy of religion in the form of a dialogue is certainly to be understood as a measure of precaution. At that time people ran a risk in speak-

ing their mind plainly. Hume did not even venture to publish the Dialogues himself, but he attached much importance to its being published after his death. His friends, Adam Smith, the famous political economist and philosopher, and Wm. Strahan, his publisher, did not venture to undertake the publication. Hume had foreseen this circumstance, and in his last will he appointed the younger David Hume, his nephew, to publish the Dialogue in case of its not appearing within two years and a half after his death.

In this Dialogue Hume gives his own conception of life; though he makes some reservations, it is a fact beyond dispute that Philo, and only he, represents Hume's own opinions. These are practically far behind the English deism and may be summed up in the following words. It is no good advancing arguments for any religious doctrine, not even for the general dogmas of "natural religion." In contemplating life with all its contrasts we are not even justified in assuming as reasonable the theory of a benevolent and mighty Being. The true conclusion for human beings is the belief in a world, carrying on its operations, indifferent to all our notions of good and evil. The world itself is neither good nor evil. "It were therefore wise in us to limit all our inquiries to the present world, without looking farther. No satisfaction can ever be attained by these speculations which so far exceed the narrow bounds of human understanding" (Part IV and XI)*. A further penetration into the treatise will make it evident that Hume's real aim was against deism, natural religion founded upon certain theoretical or moral arguments. Deism had made revealed religion irrational. Hume pointed out that religion is irrational, even in its abstractest and most rational form, the belief of the deist in theoretical or ethical rationality. The words finishing *Natural History*

* *Vide* Green & Grose, II, p. 409.

of Religion run parallel with those sentences of Philo, imparting the innermost recesses of Hume's philosophy of life. His position is that of pure positivism, which does not leave even religious and moral questions as ultimate questions, a positivism doing away with those questions which are excluded from any rational solution, not acting in this way to end in a barren skepticism but in the work of secular life, the most fertile and most positive of all. Our path through life becomes less frightful when we perceive that gods and hells are only dreams and chimeras. The persons undertaking the mere secular work with the greater vigor are those who consider it their only object of life, whose limit is the limit of all things. In his works Hume imparts to us his wisdom of life which probably is to become life's final wisdom. He speaks with plainness and simplicity, disdaining the vague symbols and quaint words which so often have slurred and will slur the simple gospel of life. Hume's ending in this rigorous, positive conception of life was not due to indolence; on the contrary, he went to the bottom of the question. In his view it was man's duty to surrender everything to humanity.

No doubt the reader will wonder why Hume constantly treats of the true and genuine theism, founded on incontestable, rational arguments, especially on those tending to prove the adequacy of nature. But all this is *vox et praeterea nihil.* Hume has considered it convenient to take refuge in the abstract deism. In each chapter he makes it an official bow, maintaining the old superiority which characterized his occasional bows to Christianity and to the Established Church. One has to remember that Hume himself was the publisher of this work, and Hume was a cautious man disdaining religion and metaphysics too much to entertain any wish of being further inconvenienced by these things which were utterly indifferent to him. In a famous letter to his friend Edmonstoune Hume determines

what character a young clergyman is to assume. The young man is a sort of disciple of Hume's, having acquired notions not very consistent with his priestly character, i. e., he does not believe in all of the Thirty-nine Articles. In Hume's opinion he is to accept of the living with an easy mind. Unfortunately he himself had spoken his mind too plainly to be a hypocrite in this particular, but he advises every one not to turn martyr in favor of some quite indifferent opinions, concerning questions unknown to every one, but in silence to worship the gods in conformity with the custom of the empire. "Did ever one make it a point of honor to speak truth to children or madmen?" (Burton, *Life and Correspondence of David Hume,* 1846, II, 188). Hume has been reproached for paying compliments to Christianity, a practice taking example from the antecedent philosophers though contrary to Hume's persuasion. To call this proceeding hypocrisy would be rather a strong assertion. In the first place these sentences are so cold and formal that one cannot possibly attach too much importance to them. In the second place Hume did not wish to make himself a martyr for the sake of Christianity. Hume never became a martyr; his very positivism must needs consider it a mere stupidity to aim at a martyrdom which could not benefit anybody. Those having a mission in life are the very persons to comply with regard to details in order to conquer when opposed to questions of vital importance. They make a contrast to the little ones first seeking the kingdom of God. Hume sacrificed the formalities in order to maintain the realities. Though he started with a ceremonious bow he preferred to stand as a free and independent man—rather than run the risk of being brought down or crushed by a religion whose freedom in heaven relied on the most brutal instruments of power ever employed here on earth. To do in Rome as the Romans do, is a good moral principle; if the State demands

it one is to sacrifice to the image of Cæsar; i. e., only, if in doing so one acts for the general good, without believing that a trifle of frankincense might bar the road to heaven. Hume's contemporaries did not mistake his opinions, a fact shown for one thing in the statement of his funeral. It was thought necessary that his grave should be watched by two men for eight nights, to prevent it from being violated by the mob.

Hume has smilingly told an untruth in every chapter of the work here before us, he has made the official bow to children and madmen, fully aware that this reverence would make even more intelligent people consider him a deist—an opinion which was justified. On the other hand he was no doubt perfectly sure that intelligent people later on would understand his true mind, conceiving that the two works practically making the strongest attack on any religion, in regard to English deism, may be understood as the continual refrain of Marc Antony's dreadful speech of accusation,

"For Brutus is an honorable man."

English natural religion, rationalism, or deism was sufficiently honest; so honest as to make even Hume use it as a screen in his dealing with children and madmen; otherwise he knew perfectly well that his stand and that of the deist differed infinitely more from each other than did deism from positive religions. Hume's protest against the name of atheist (*vide* Burton, II, 220) was due to his dislike of all that sort of indications. In his opinion the affirmation of the nonexistence of God was as dogmatical as the sure belief in his being. We know nothing and cannot possibly know anything concerning the world, its origin or ruin, of the continuation or passing away of its values. Nor ought we to occupy ourselves with that sort of ideas which only tend to distract the work from temporal society, cause strife and anxiety, suffer essential and

unessential questions to make distinctions where no distinctions ought to be,—this was Hume's conception, which he maintained against the positive popular religions, nay even against the natural religion behind the honesty of which he sought shelter.

In this connection I had better premise an explanation of a definite head in Hume's terminology. On almost every page he uses the word theism, which he opposes to polytheism, used of any religion having several gods or demi-gods. Polytheism identifies all systems of idolatry, national religion, paganism and superstition. It is more difficult to explain the meaning of "theism," used by Hume in two significations. Generally it denotes monotheism (used in section IX), a term however including "genuine theism." Only in one passage he uses the word deism (*vide* section XII, where he speaks of "avoiding the imputation of deism and profaneness") but this "genuine theism" is indeed the very natural religion laid down by the English deists, starting with Herbert of Cherbury, ending with Hume, a fact plainly shown by Hume's own definitions (sections VI, and XIV). According to this definition the popular monotheism and the "genuine theism" (i. e., deism), both included in the appellation of theism, differ as to their principles. The former asserts a "particular providence," i. e., the deity may be induced by prayer to encroach upon the natural causes, breaking his own laws. The latter admits of "an original Providence," i. e., the deity governs the world according to general, settled laws, the course of which is free and undisturbed. In this connection I shall call attention to the *Enquiry Concerning Human Understanding* (1748, section XI, "Of a Particular Providence and of a Future State") and further to a letter to Mure, in which Hume decidedly maintains that "the prayer is very dangerous, and leads directly, and even unavoidably, to impiety and blasphemy"

(Burton, I, 162-164). Considering Hume's individual view of religion and the caution he showed when he mentioned it before the public, it will easily be understood that it was his very wish to leave the term theism in vagueness. With the word theism on his lips he could make his official bow both to the right and left flanks of Christianity. To the right even able to attack it in driving at Catholicism, paying a special reverence to the Church of England. To the left, bowing to the "sublime doctrines," which the English deism considered the heart of all religion, both from a theoretical and—chiefly—from an ethical point of view.

But there is another fact causing the vagueness of the term theism. Hume was practically unable to draw the line between theism and polytheism. His very superiority appears in his perceiving that the distinction between one god and several gods has no scientific signification. In the end the notions converge into one another. The theism professing "a particular Providence" is considered as belonging to the popular religions. After all Hume feels convinced that all religion as it really exists, is popular religion or superstition (*Dialogues,* Part XII; cf. Jodl, *Leben und Philosophie David Humes,* p. 194). The "genuine theism" does not really exist, unless in the mind of a few philosophers whose meditations are far from life's reality. There only remains a vague distinction between the higher and lower strata within religion, and Hume's ingeniousness manifests itself in his putting down the law for the principles of religion. He is the first to point out that the strata are fluctuating. The religious conceptions having obtained a certain height are either entirely undone or they are dragged downwards into the great living depths from which they rose. The everlasting communication with this depth is the condition of their carrying on their life. There is no limit between the higher and

lower religious strata, only a continual movement, an everlasting flux and reflux. According to the interpretation of the words theism and polytheism are to be defined as higher and lower strata within religion. Hume's concentrating all his inquiries into the relation of these strata is the cause of his penetrating more than any other into the innermost problem of religious science. The philosophers of quite recent days can hardly be said to have surpassed him.

Hobbes (1588-1679) laid down the first stone of the edifice of the modern science of religion by his indication of the "unknown causes," which are embodied and deified. The gods are created by our ignorance of real causes and by our fear of what is to befall us in time to come; their supernatural, incorporeal or immaterial characters "are of the same substance with that which appeareth in a dream to one that sleepeth or in a looking-glass to one that is awake" (*Leviathan,* 1651, Part XII). But Hume is the masterbuilder who completed the edifice in its main features. By his fundamental assertion that all forms of religion are to be explained in a psychological and historical way, he laid down the basis which is to be taken for granted in the examination of any religion, be it called a higher or a lower one. His way of putting the question concerning the development of religion indicated the course of all science of religion.

I dare say that Hume's little treatise is so far beyond all that has been written down to quite recent days that its ideas have entirely surpassed peoples' understanding. Generations to come will be astonished to see how all threads meet in Hume's stating of the problems. Having done with the psychology of individuals and of races, walking along vast and troublesome roads passing through the history of all religions, we shall arrive at the views, seen for the first time in their abstract, principal form by

Hume's bright eye. Then we shall certainly feel regret in realizing that at an earlier date we might have advanced even beyond our present position, if we had founded our exertions on Hume's working hypothesis and method of work instead of wasting an enormous amount of scientific energy in working with vain views and theories, descended from English deism to German romanticism, first faced by Feuerbach (1804-72), afterwards by the modern English school in the science of religion.

As already pointed out, the distinction between the higher and lower forms within religion is the fundamental view of the whole treatise. As this view furnishes the clue to the whole disposition, a little difficult to catch without a careful study, a short representation of the content—starting from this fundamental view—may be useful to the understanding.

The work is made up of two main divisions, the former is a historical investigation of the higher and lower strata within religion and their mutual relation (Section I-VIII), the latter is an estimation of this relation. Hume's historical way of putting the question turns this estimation into a comparison between paganism and Christianity (Sections IX-XV).

The different chapters are connected in the following way: The work is opened by a short psychological introduction. In the first chapter Hume maintains that the lower religious strata have been the original ones. It is easily understood that the adherents of "natural religion" came to the conclusion that the universal dogmas expressed in this religion were the principal ones also from a historical point of view. This idea was already entertained by Herbert of Cherbury, but it was more emphasized by his successors Browne (1605-81) and Blount (1654-93). "Natural" religion became the primitive religion of mankind, but experience having shown how far the positive

religions have diverged from their origin, the thought of a historical misrepresentation was obvious. The cause of this misrepresentation had to be looked for among the people profiting by everything in religion which was considered an unnecessary and obnoxious appendix to the pure natural religion, i. e., among the priests. The fact of this being so is the origin of two notorious historical theories: primitive monotheism and the explanation of religion given by priestcraft. In the history of philosophy the latter theory originated with Kritias, the tyrant and sophist. In his opinion the first lawgivers created the gods from reasons of subtlety. By a concise, careful argumentation Hume demonstrates the absurdity of the belief in primitive theism.

The second and third sections examine the origin of the lower forms. Having made a bow to theism so ingenious that it really becomes a bow to polytheism, Hume proceeds to show how primitive man's incoherent range of ideas must create a variegated confusion of gods, acting in an arbitrary way. Furthermore he shows that primitive man's creation of these beings is not due to intellectual motives, i. e., curiosity concerning the origin of the world; it is only caused by the practical desire to procure the daily necessaries of life. But primitive man does not know the causes of happiness and unhappiness, "the unknown causes," which already Hobbes considered the obscure gaps in our knowing, where the gods could live, but from where they were displaced by the physical understanding. We conceive those "unknown causes" like ourselves (*Prosopopoeia*). The bringing forward of this analogy is the germ of the later English theory of animism and marks the continuation of Xenophanes's ingenious fragment, which is the origin of the European science of religion: "The mortals say that the gods were born like themselves, had apparel, voice and form in conformity with them.

But if the oxen, horses, and lions had hands and like men were able to form pictures, the horses would form the gods like horses, the oxen like oxen, all species of animals would form their gods exactly in their own likeness. The Ethiops imagine their gods black and flat-nosed, the Thracians conceive their gods with blue eyes and red hair." (Diels, *Fragmente der Vorsokratiker,* p. 54). Hume affirms his theory by pointing out that the increase of superstition is proportionate to the difficulty in indicating its real causes, a circumstance explaining the fact that people are oftener led into religious notions by fear than by hope.

Section IV is an interpolation; it shows that the deities were not originally considered the creators of the world and thus defines the contrast between the higher and lower strata. Section V again takes up the thread, giving the further development of the lower strata. As early as section III Hume began to discuss the notion of local and special deities. In this chapter he points out that the distribution of distinct provinces to the several deities must grant them some attributes, thereby giving rise to allegory; he draws attention to apotheosis, the fact that mankind is able to elevate superior men into gods, further showing that the public devotion may be further increased by art's representation of divinities. At last he gives a resumé of the five first chapters.

The three following sections treat the relation between the higher and lower strata. Section VI makes it evident that the higher strata originate from the lower ones. Hume mentions the agents connecting polytheism and theism. Those agents are (1) the worship afterwards called monolatry; (2) the conception of a "patron-deity"; (3) the existence of a social order among the gods, i. e., a further development leading the original analogy from the individual domain into the social one; (4) adulation towards the god whose assistance is invoked. Section VII

confirms the doctrine that theism is hardly ever found in a pure state among the popular religions. Hume asserts that even if religion tells you that the Deity is in possession of all sublime qualities, the assent of the vulgar is merely verbal: the old religious strata still exist as the essential part of religion. After all the "higher" notions are but empty words, epithets which people dare not refuse verbal assent, but whose life only consists in words. Hume plainly advances the idea quite recently expressed by I. G. Frazer in the following words:

"Brahmanism, Buddhism, Islam may come and go, but the belief in magic and demons remains unshaken through them all, and, if we may judge of the future from the past, is likely to survive the rise and fall of other historical religions. For the great faiths of the world, just in so far as they are the outcome of superior intelligence, of purer morality, of extraordinary fervor of aspiration after the ideal, fail to touch and move the common man. They make claims upon his intellect and his heart to which neither the one nor the other is capable of responding. The philosophy they teach is too abstract, the morality they inculcate too exalted for him. The keener minds embrace the new philosophy, the more generous spirits are fired by the new morality; and as the world is led by such men, their faith sooner or later becomes the professed faith of the multitude. Yet with the common herd, who compose the great bulk of every people, the new religion is accepted only in outward show, because it is impressed upon them by their natural leaders whom they cannot choose but follow. They yield a dull assent to it with their lips, but in their heart they never really abandon their old superstitions; in these they cherish a faith such as they cannot repose in the creed which they nominally profess; and to these, in the trials and emergencies of life, they have recourse as to infallible remedies, when the

promises of the higher faith have failed them, as indeed such promises are apt to do." (*The Golden Bough,* 2d edition, III, p. 49.)

Hume shapes his thought ingeniously in section VIII, dealing with the flux and reflux of the higher and lower religious strata. The fluctuation takes place according to the law which I have called *"lex Hume."* (*Archiv für Religionswissenschaft,* IX, 415.) According to this law there is within religion a tendency to elevate the deity as much as possible, but this abstraction disengages the comprehension from its native soil. Common people stick to their concrete religious ideas, a fact causing the movement of a lower stratum towards the surface, when the pressure has ceased which the deity—now abstract—exercised when a concrete notion. Hume calls this new emerging stratum "middle beings," and he is fully justified in asserting that this fluctuation in the religious strata takes place always and everywhere, not like a sudden eruption, but representing the very life and working of religion. Hume's thought is expressed in brief, distinct words; when entirely worked out it will certainly illustrate religion's obscurest, innermost nature more than any other point of view. After all the thought is an ingenious application of "the theory of abstract notions," put forward by Berkeley (1685-1753) in his *Principles of Human Knowledge* (1710), a theory which in the religious science has an extensive scope—in downright contradistinction to the abstractions of natural religion and all the bloodless children thus engendered in the history of philosophy. It may be that Hume had some foreboding of this scope, but he has hardly perceived it clearly, otherwise he would probably have scrutinized the law from an individual and social point of view, examining the very seats of the fluctuation. Thus he would have been called back to what he previously indicated: that religion itself is fixed and unchangeable, the

flux and reflux being due to interaction between the real religious strata and the other, higher ones, i. e., positive knowledge and worldly ethics. The former strata were insensible, though always moved by the agents arising from them, i. e., both theological and ethical systems.

The last chapters give an ethical estimation of the relation between the higher and lower strata. The vague notions of polytheism and theism are now historically defined, the lower strata being identified with all pagan religions, while the higher strata are nearly assimilated with the Jewish-Christian religions, partly with Islam. Hume concluded his historical account by indicating that the lower forms survive unaltered beneath the higher ones, since higher religious formations are properly speaking only abstractions and empty words. Here he shows that the lower strata really are the better ones, because the so-called higher ones in fact are nothing but the lower ones. Their superiority is but empty words, they have the same deficiencies as the so-called lower strata besides the additional one of pretending something more. In short: Hume wants to settle between paganism and Christianity. In section IX he emphasizes the toleration of idolatry as opposed to Christianity's persecutions and multitude of human sacrifices. Incidentally he states his theory of sacrifices. In section X he lays stress on the social virtues of paganism as distinct from Christianity's contempt of world and mankind. His words quite correspond to those of Schiller in *Die Götter Griechenlands,*

> "Da die Götter menschlicher noch waren,
> Waren Menschen göttlicher."

In section XI Hume shows that paganism is more sensible than Christianity, on account of its fundamental view of the gods and the fact that it consists in cults more than in theory, which made it less pretentious than the Christian theology. He maintains that in controversies between

Christian sects the reproach of heresy has always been stuck to the more sensible part. The ideas of section XII are somewhat difficult to catch. With a very polite bow to the Church of England, Hume derides the Christian (Catholic) rites—for instance the Lord's Supper—which in his opinion are as absurd as the ideas of paganism. He examines the relation between peoples' creed and their own conjecture about this creed, observing that human conscience includes the greatest contrasts: a concise, scientific range of ideas alongside of the most superstitious notions,—a profound psychological remark, which as to the individual consciousness forms the supplement to Hume's assignment of the lower strata which survive unaltered in the people. In agreement with the words of Lucretius Carus,

"Primus in orbe deos fecit timor,"

and with Hobbes's psychology of religion in *Leviathan*, Hume had emphasized fear as the strongest religious impulse. The gods are created by fear, and fear secondarily begets praise, elevating the gods. But in Hume's opinion this idealization—if it was not *idola fori*—according to its origin only indicated an enlargement of the power of deity. The gods had to remain on an ethical level with the men who created them in their own image. As set forth in section XII the consequence is that the fear of the god magnifies in proportion as he increases in power. This enlargement of the deity's power is contingent upon no other deities being acknowledged beside him. In each religion there are two poles represented on one hand by the kind, beneficent gods, on the other by the noxious, wicked ones. "The higher the deity is exalted in power the lower is he depressed from an ethical point of view." In the so-called higher religions the tension becomes strongest in the negative pole: a fact illustrated by means of Judaism and Christianity. Hume cautiously screens himself by

Andrew Michael Ramsay (1686-1743) the friend of Fenelon and author of *Philosophical Principles of Natural and Revealed Religion, Explained and Unfolded in a Geometrical Order* (1749). In section XIV Hume repeats that the ethical idealization of the deities is only a verbal definition. Religion will always contradict morality from the mere cause of its emphasizing other things than an honest life. Were we to suppose a purely moral religion, the only cult of which consisted in sermons of a virtuous conduct of life, the very attendance on these sermons would soon be turned into religion. Any religion is compatible with the greatest baseness, nay it rather produces it, for the fervor of religious passion arises from a range of ideas entirely different from man's sense of truth and goodness. In the last chapter Hume sums up the last six chapters, setting forth the contrast between the doctrine of the higher religious tenets and the life of their adherents. He concludes by maintaining that religions do not give any real answer in reply to the question of life and death, but that the history of religion in showing the mutual struggle of the different religious systems may also be of practical importance in enjoining us to be cautious in our relation to those questions. I believe Hume was right in this particular. What the more abstract criticism of deism failed to reach as to religion may surely be reached more easily by the path of historical investigation. But whether an adherent of Hume's conception of life or not, one is almost bound to grant that the contest between religious and non-religious conceptions approaches more and more the mere historical domain, a fact proved by the time succeeding Hume's—in spite of the recent American religious psychological humbug, in spite of all its desperate endeavors to make science founded on "mind-cure" and statistics of conversion. Be the expectations and the result as they may, only historical meditations and arguments give value to

attack and defence. But whatever stand we will take in the strife or what special domain within the science of religion we wish to peacefully explore, we ought always to return to the classical work of religious science and bow our heads in reverence to the great founder of this science.

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A MODERN ZENO.

ZENO of Elea is famous mostly for his so-called "argument" to the effect that in a race between Achilles and a tortoise with the latter starting in advance a certain distance, Achilles can *never* overtake the tortoise although he may run many times as fast as his slow competitor. For, says Zeno, when Achilles reaches the spot where the tortoise started the other will have advanced to another point, and when Achilles has reached this second point the tortoise will have gone on to a third point and just so on and on the race will continue *ad infinitum,* the tortoise being always a little ahead. It is curious to see how this little *non sequitur* has perplexed people, many of them of excellent intellectual standing. Thus the famous logician Sir William Hamilton said the "argument" was unanswerable.

It is altogether beside my present theme to state wherein the catch lies, so I will merely say that the conclusion is no consequence at all from the premises. The "argument" stripped of its disguises is just this. Achilles can never overtake the tortoise because he cannot overtake it in any less time than it takes to do so.

Among men there is no habit more inveterate than the persuasion of each individual that he personally is immune from slips in reasoning. All around him during almost every day of his life he takes notice how badly other people reason without ever saying to himself that probably he is

like other people in the same regard. So in view of the incontestable fact that men, yea, even men most eminent in intellectual power and cultivation, do sometimes err in reasoning, I make bold to confess a growing measure of misgiving as to certain geometrical results that have played and are still playing a conspicuous rôle in the mathematics of the present epoch. I refer to the so-called non-Euclidean geometry, and I propose to utter a little note of protest or rather of question. That is to say, some considerable study of the famous brochure of Lobatchevsky on parallels leaves my mind in such a state that I desire greatly some further instruction.

It is generally recognized that the problems of parallelism and of the angle-sum of the triangle are only two different aspects of a single problem. The solution of either involves the solution of the other. Lobatchevsky approaches the problem from a definition of parallelism. He adopts most of the fundamental definitions and conceptions of ordinary geometry and quite a number of the initial theorems. He defines the straight line in an original way saying: "A straight line fits upon itself in all its positions. By this I mean that during the revolution of the surface containing it the straight line does not change its place if it goes through two unmoving points in the surface (i. e., if we turn the surface containing it about two points of the line, the line does not move)."

Now it is one thing to give us an idea of an object and quite another to so define it that its essential quality or qualities shall be definitely stated. Lobatchevsky's definition is no special improvement upon the other current definitions. It is a *suggestion* rather than a definition. Of late the statement that a straight line is determined by two of its points has gained favor as a definition, and it is true that a single particular straight line is by two points of it determined to be that several and singular straight line

after it is known to be straight. But two points do not determine *the* straight line in general, that is to say, no two points of it being given will avail in the least as a test whereby to determine whether or not a line in question as to its straightness is really straight.

What is needed in a definition of the straight line is a statement or conspiracy of statements that shall express and exhibit to the intelligence the matters of fact in virtue of which it has that quality we call straightness. If this can be done in any other way than by defining a rule according to which the points that stud it are distributed so as to make it straight, then I am at a loss to conceive what that way can be. Moreover the straight line ought to be defined so as to be put right out in space in perfect self-sufficiency. I shall later on submit a definition that seems to me to fulfil the requisites I have mentioned, but for the present I must keep to the ways and results of Lobatchevsky.

Lobatchevsky begins his original matter with his Theorem 16 as follows:

"All straight lines which in a plane go out from a point can, with reference to a given straight line in the same plane, be divided into two classes—into *cutting* and *not-cutting*.

"The *boundary lines* of the one and the other class of those lines will be called *parallel to the given line.*

"From the point A (Fig. 1) let fall upon the line BC the perpendicular AD, to which again draw the perpendicular AE.

"In the right angle EAD either will all straight lines which go out from the point A meet the line DC, as for example AF, or some of them, like the perpendicular AE, will not meet the line DC. In the uncertainty whether the perpendicular AE is the only line which does not meet DC, we will assume it may be possible that there are still other lines,

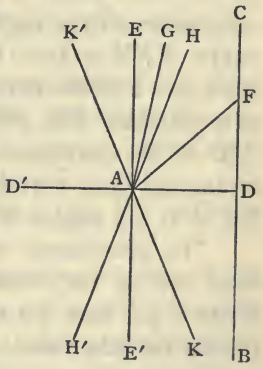


Fig. 1.

for example AG, which do not cut DC, how far soever they may be prolonged. In passing over from the cutting lines, as AF, to the not-cutting lines, as AG, we must come upon a line AH, parallel to DC, a boundary line, upon one side of which all lines AG are such as do not meet the line DC, while upon the other side every straight line AF cuts the line DC.

"The angle HAD between the parallel HA and the perpendicular AD is called the parallel angle (angle of parallelism), which we will here designate by $\Pi(p)$ for $AD = p$.

"If $\Pi(p)$ is a right angle, so will the prolongation AE′ of the perpendicular AE likewise be parallel to the prolongation DB of the line DC, in addition to which we remark that in regard to the four right angles, which are made at the point A by the perpendiculars AE and AD, and their prolongations AE′ and AD′, every straight line which goes out from the point A, either itself or at least its prolongation, lies in one of the two right angles which are turned toward BC, so that except the parallel EE′ all others, if they are sufficiently produced both ways, must intersect the line BC.

"If $\Pi(p) < \frac{1}{2}\pi$, then upon the other side of AD, making the same angle $DAK = \Pi(p)$ will lie also a line AK, parallel to the prolongation DB of the line DC, so that under this assumption we must also make a distinction of *sides in parallelism.*

"All remaining lines or their prolongations within the two right angles turned toward BC pertain to those that intersect, if they lie within the angle $HAK = 2\Pi(p)$ between the parallels; they pertain on the other hand to the non-intersecting AG, if they lie upon the other sides of the parallels AH and AK, in the opening of the two angles $EAH = \frac{1}{2}\pi - \Pi(p)$, $E'AK = \frac{1}{2}\pi - \Pi(p)$, between the parallels and EE′ the perpendicular to AD. Upon the other side of the perpendicular EE′ will in like manner the prolongations AH′ and AK′ of the parallels AH and AK likewise be parallel to BC; the remaining lines pertain, if in the angle K′AH′, to the intersecting, but if in the angles K′AE, H′AE′ to the non-intersecting.

"In accordance with this, for the assumption $\Pi(p) = \frac{1}{2}\pi$ the lines can be only intersecting or parallel; but if we assume that $\Pi(p) < \frac{1}{2}\pi$, then we must allow two parallels, one on the one and one on the other side; in addition we must distinguish the remaining lines into non-intersecting and intersecting.

"For both assumptions it serves as the mark of parallelism that the line becomes intersecting for the smallest deviation toward the

side where lies the parallel, so that if AH is parallel to DC, every line AF cuts DC, how small soever the angle HAF may be."

This long quotation is unavoidable unless one would risk a charge of misrepresentation or garbling. It states the full substance of the author's peculiar initial premises, those that distinguish his geometry from the geometry of Euclid and his disciples. With these premises and with about a dozen theorems adopted from the ordinary Euclidean geometry he develops a sequence of theorems as follows:

"17. A straight line maintains the characteristic of parallelism at all its points."

"18. Two lines are always mutually parallel."

"19. In a rectilineal triangle the sum of the three angles can not be greater than two right angles."

"20. If in any rectilineal triangle the sum of the three angles is equal to two right angles, so is this also the case for every other triangle."

"21. From a given point we can always draw a straight line that shall make with a given straight line an angle as small as we choose."

"22. If two perpendiculars to the same straight line are parallel to each other, then the sum of the three angles in a rectilineal triangle is equal to two right angles."

In the course of this Theorem 22 he goes on to remark:

"It follows that in all rectilineal triangles the sum of the three angles is either π and at the same time also the parallel $\Pi(p)=\frac{1}{2}\pi$ for every line p, or for all triangles this sum is $<\pi$ and at the same time also $\Pi(p)<\frac{1}{2}\pi$.

"The first assumption serves as *foundation for the ordinary geometry and plane trigonometry.*

"The second assumption can likewise be admitted without leading to any contradiction in the results, and founds a new geometric science,.... which I intend here to expound as far as the development of the equations between the sides and angles of the rectilineal and spherical triangle."

Then follow Theorems 23, 24 and 25:

"23. For every given angle α we can find a line p such that $\Pi(p) = \alpha$."

"24. The farther parallel lines are prolonged on the side of their parallelism, the more they approach one another."

"25. Two straight lines which are parallel to a third are also parallel to one another."

With the completion of Theorem 25 the basis of the system of Lobatchevsky is fully laid. Theorem 23 is very inconspicuous in its enunciation but it contains matters of high significance as we shall see later on.

Now it is *true* that the assumption that the angle-sum of any triangle is less than two right angles leads to no contradictory results. If it is true for all triangles, it, of course, must be true for the isosceles right-angled triangle.

The existence of right angles and of right-angled triangles is pervadingly taken for granted by Lobatchevsky.

Now a right-angled isosceles triangle may be dissected into two other half size right-angled isosceles triangles by a line drawn from the mid-point of the hypotenuse to the vertex of the right angle, and then the two secondary triangles may in precisely like manner be each dissected into two tertiary right-angled isosceles triangles. The proof that the two secondary triangles are exactly equal to one another, that they are right-angled and isosceles, and that the four tertiary triangles are in all respects precisely in the same case is so simple in more than one way, that it would be almost an imputation upon the reader to spread it before him. But the right angle of the original triangle is a right angle, neither more nor less so that any deficiency of the angle-sum from two right angles must reside, if anywhere, in the two acute angles, and these being equal to one another, each must bear half of that deficiency. But any one of said acute angles of the original triangle is exactly equal to that acute angle of the same secondary triangle in which it belongs, that has its vertex at the ver-

tex of the right angle of the original triangle, and this angle is precisely half the said last-mentioned (right) angle.

True, we may conceive that the bisection of an angle in some way operates to bend sharply the plane of the figure along the line of the bisecting line so that the lines that bound the right angle shall approach each other, but then the angle would no longer be a right angle, and the plane of the original triangle would be that rather curious form, a bent plane.

This leads me to remark somewhat out of order that Euclid's axioms 2 to 5 inclusive are not true in general. They may be false as applied to the addition and subtraction of angles unless the angles lie in the same plane.

But bending along section lines is not at all the kind of alteration that Lobatchevsky and his disciples admit. They will not for a moment concede that their straight lines are only approximately straight, and though through all of their illustrations they borrow the use of curved lines and of surfaces that have no straight lines, they yet insist that the lines they refer to as straight are in all sincerity completely and rigorously straight. Since we have no applicable criterion of straightness we can see how hard it is to invent any crucial test.

This claim that the assumptions of Lobatchevsky lead to no contradictory results has been so conspicuously proclaimed and moreover it is so plainly the very core of all the import of the new geometry that it sets a person of a skeptical turn of mind to wondering when and where and how any adequate tests of his assumptions have been made. Not certainly in Lobatchevsky's little brochure. That contains in all only thirty-six separate theorems and of these all but twelve are in perfect harmony with Euclidean assumptions. Even of these twelve three are nothing but rather elaborate definitions leaving only nine theorems on

which to rest the claim of no contradictory results. And even as to these nine we shall, I think, later on see something pertinent to the weight of their argument. It is a little curious too to observe that of the non-Euclideans only Lobatchevsky and Bolyai deal with the matters in question by synthetical methods; all the rest are analysts.

But let us now look a little at the "angle of parallelism" with its other face, the deficiency of the angle-sum from two right angles, and see what it is and to what it leads. It must never be forgotten that the angle of parallelism is not proposed as a constant angle but is said to depend for its extent upon the extent of the line which makes with the parallel the angle of parallelism. It is not Π simply and constantly but $\Pi(p)$, the (p) standing to mark the dependence of the angle upon the extent of the line mentioned.

Had Lobatchevsky used the phraseology of the differential calculus he would have said that the angle of parallelism is a function of the line which makes with the parallel the said angle of parallelism, the said line standing as the independent variable. For every length of the line (p) there is supposed to be a different angle of parallelism, and since these lengths are infinite in number we of necessity have to do business with an infinite number of angles of parallelism. When the independent variable is in the close neighborhood of infinity the angle of parallelism is taken to be in the close neighborhood of zero and at the very limit the parallel is there taken to be coincident and for a moment, at least, current with the line that elsewhere makes with it the angle of parallelism (Theorem 23, paragraph 4).

In view of this and taking also into account various phrases current among the disciples of the modern Zeno. such as curvature of space, the divergence of perpendiculars, etc., the inexpert, and I surmise some of the non-

inexpert, mathematicians would be apt to feel misgiving lest there may have become insinuated into the whole doctrine some subtile fallacy. With such volatile elements to work with, it would be no wonder if estimates were more or less loose and floating.

There is ground for suspicion that the countenance given to non-Euclidean geometry by a number of eminent mathematical experts has somewhat overawed others that are very meagrely satisfied. These experts have wrapped up the doctrine in what to many is a maze of analytical language that requires a good deal of analytical erudition to compass and thoroughly possess. It makes the logician inclined to ask if these analysts have not mistaken some mere grammatical collocation of their analytical language for a real ideal possibility. We can say "round square," but nevertheless a "round square" is an absurdity. May not such analysts have made similar constructions? We shall later on say something more on this point.

Lobatchevsky however delivered his doctrine synthetically, and it is with his version that our present note of inquiry is concerned.

There is another thing too about the "angle of parallelism" that challenges attention. He says of the lines radiating from A and intermediate between the (p) line and the perpendicular thereto at A that they divide into two classes, lines that cut DC and lines that do not cut DC. But he definitely puts his parallel among the lines that do not cut. But how about the relation of that parallel to the next line, that is, the line that is the last of the lines that cut DC? Does it make an angle with the parallel or is it the same line? Do we not here begin to touch the very heart of the problem to find it a plain case of Zenoism?

If the lines make an angle I suppose that that angle can be bisected, indeed n-sected, and such section-lines will be lines that neither cut nor non-cut. If the lines are only

one single line then we have a line that both cuts and non-cuts. In short, we have the ever-recurring puzzle of how to formulate continuity.

I have long had an opinion of my own as to the true avenue of reconciliation and without any sort of pretense that said opinion is especially precious, I here state it for whatever it may prove to be worth.

In dividing the lines in question into cutting and non-cutting lines Lobatchevsky observes the logical law of contradiction, viz., Any A is not any not-A. This law has two applications, subjective and objective, and the objective application includes our ideas when the same are objectively regarded. In its subjective application the law is, at least in our present state of intellectual development, insuperable. Its observation seems to be an indispensable condition for thought at all. So too in its objective application to things naturally discrete from one another there is at least, no occasion to dispense with its universality and necessity. But in its objective application to matters that involve the continuity of the objects considered the law of contradiction is not always of necessary compulsion, but at the boundary where A and not-A merge with one another we have the right, and as I say the perfectly logical right to regard the boundary specializations either as A or as not-A, just as one or the other fiat of ours may be suitable for our turn.

There is another thing about Lobatchevsky's parallel that ought to be emphasized. His "angle of parallelism" he makes less than a right angle but he does not ask for any *finite* lessness. *Any* concession from a right angle even though it be infinitesimal, aye, even though it be an infinitesimal of the infinitieth order, will satisfy his demands. And at the other end of the parallel he only asks that it shall just clear the perpendicular, and *any* clearance even of the most infinitesimal sort will do. In fact this sort of

clearance is just what he does expressly demand. Now an infinitesimal is just precisely that sort of a quantity that *no finite number thereof will avail to make up any finite quantity.* Yet in his Theorem 23, viz., "*For every given angle* α *we can* find a line p such that $\Pi(p)=\alpha$" he proceeds to state his construction thus:

"Let AB and AC (Fig. 10) be two straight lines which at the intersection point A make the acute angle α; take at random on AB

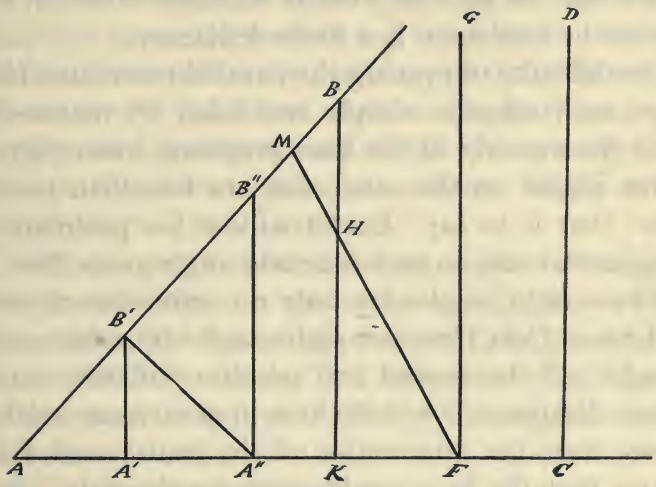


Fig. 10.

a point B′; from this point drop B′A′ at right angles to AC; make A′A″=AA′; erect at A″ the perpendicular A″B″."

And then we find him going on as follows:

"And so continue until a perpendicular CD is attained, which no longer intersects AB. This must of necessity happen, for if in the triangle AA′B′ the sum of all three angles is equal to $\pi-\alpha$, then in the triangle AB′A″ it equals $\pi-2\alpha$, in the triangle AA″B″ less than $\pi-2\alpha$ (Theorem 20), and so forth, until it finally becomes negative and thereby shows the impossibility of constructing the triangle."

That "and so forth until" is richly monitory of the Zenonian "and so on *ad infinitum.*"

Now the validity of the construction proposed all depends upon whether *a*, the deficiency of the angle-sum from two right angles is finite or infinitesimal, and the fact that Lobatchevsky does not and will not expressly commit himself to *any* finite deficiency, is what his brochure as a whole makes abundantly manifest. Yet in spite of that we find him here in the very first theorem after he starts with his peculiar assumptions completed—a theorem in virtue of which alone his peculiar results emerge—covertly assuming that the deficiency is a finite deficiency.

The difficulty of proving the parallel postulate of Euclid resides, as I suppose, simply and solely by reason that it affirms the meeting of the lines proposed when they make interior angles on the same side are less than two right angles; that is to say: Euclid widens his postulate so as to be general and so as to include angle-sums that differ from two right angles by only an infinitesimal amount. Had he said "less than two right angles by a finite amount of angle" all the special and peculiar difficulty would, I suppose, disappear, for if the lines approach one *n*th of any distance from the intersection of the transversal, for that distance, then the lines would meet at *n* times that distance from the transversal. Of course the thus restricted postulate would not answer for geometrical purposes, and Euclid respected its debility.

* * *

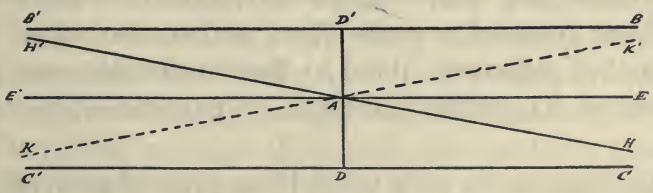
But it is time to search for results ourselves. It seems to me a pretty plain proposition that if the angle-sum of the triangle may be, and is supposed to be, less than two right angles, then such a figure as a plane rectangle is impossible. There is not angle stock enough in the two triangles into which a plane quadrilateral may be bisected to make up four right angles. A plane quadrilateral may on the assumption in question have one, two, perhaps three,

but *not* four right angles. As a corollary a square is impossible and the cube is in like case.

Since the service of arithmetic, algebra, and all mathematical analysis in geometry is due entirely to the exact appropriation of those branches of science to the Euclidean assumptions, may it not well be wondered what good and true services they can render on behalf of assumptions that conflict with those of Euclid? When rectangles, squares, and cubes are impossible what geometrical meaning can products and quotients, powers and roots have? And how can addition and subtraction manage to straddle congruently between the Euclidean and the non-Euclidean products and powers, quotients and roots? How analysis can confirm non-Euclidean assumptions seems to me to be a matter needing explanation.

I will now proceed to state and explain certain considerations that seem to me to be wholly irreconcilable with any claim that the assumptions of Lobatchevsky lead to no contradictory results and that utterly prevent the same from presenting that harmony that is the mark of true science.

Consider the figure following.



AD is here the (p) line, AH the parallel making the angle of parallelism HAD. DC is the perpendicular to the (p) line at D, and AE the perpendicular to the same line at A. Draw also through A the line AK, making the angle KAD equal to the angle of parallelism HAD. Now prolong all of these lines, except the (p) line, boundlessly in straight lines but in the reverse sense: DC towards

and beyond C′, AE towards and beyond E′, AH towards and beyond H′, and AK towards and beyond K′. Prolong the (p) line to D′, making AD′=AD and through D′ draw the boundless straight line BD′B′ perpendicular to DAD′. Then the angle H′AD′ will be equal to the angle of parallelism HAD, according to Theorem 6 (vertical angles). Both will be angles of parallelism $\Pi(p)$. AD′ will be a replica of the (p) line and DD′$=2(p)$. In short the figure H′AD′B′ will be in all respects the same case as is the case of the figure HADC. H′A will be parallel to B′D′ by the very same manner of token that HA is parallel to DC, and since "a straight line maintains the characteristic of parallelism at all its points" (Theorem 17) the whole line H′H is parallel to B′D′; and again, since "two lines are always mutually parallel" (Theorem 18) B′D′ is parallel to H′A and to H′AH, and still again by Theorem 17 B′D′B is parallel to H′AH. By precisely the same manner of token the line H′AH is shown to be parallel to C′DC and C′DC parallel to H′AH. But "two straight lines which are parallel to a third are also parallel to one another" (Theorem 25) so that B′B is parallel to C′C and both being perpendicular to DAD′ it seems to be shown that *some* lines at least that are each perpendicular to the same transversal are parallel to each other, and it also seems to be shown that whenever the (p) line is double some other instance of its species the angle of parallelism is a right angle.

This looks to me very much like a proof that in all cases the angle of parallelism is a right angle.

Now by the very same course of deduction (no step of which is unsanctioned in the "system" of Lobatchevsky) the line KAK′ is shown to be parallel to HAH′ and to EAE′, in spite of the rather important feature that they cut one another at A.

So, unless I am altogether mistaken in the above, we

find ourselves in view of a very curious and remarkable phase in the history of geometric research. We find Lobatchevsky hitting upon the right and sufficient way of proving the parallel postulate of Euclid. We find him pursuing that way with eminent success for a while, but at Theorem 23 getting shunted by the confounding of the infinitesimal with the finite.

Still it may be that there is something about the matter that I do not understand. If so I can only protest that my failure is not due to any lack of very respectful (I do not want to say absurdly respectful) study of Lobatchevsky's little brochure.

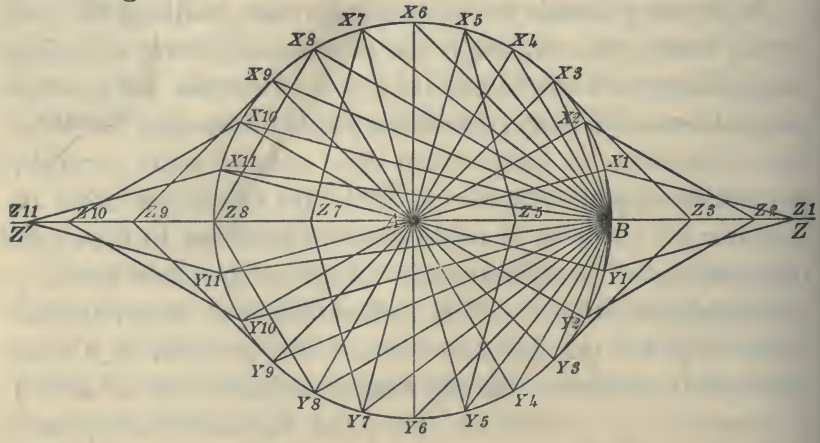
Considering that the modern man, aye, even the modern man of so-called liberal education, finds himself lost between a disposition on his part to respect the august majesty of mathematics and a disposition tempting him to regard the non-Euclideans something as the mathematician regards the circle-squarer and the perpetual motionist, it would seem as though it might be worth the while for some one of the non-Euclidean sect to so explain their doctrine as to make it manifestly clear and sound to minds as unable as mine.

It is very much to be wished that mathematicians would have less contempt for the philosophers and that the philosophers would follow less that esteem for mathematical power of survey and penetration that led Sir William Hamilton to judge them only able to walk straight in a ditch dug by others. In Dr. Paul Carus we have an instance all too rare of a philosopher fully up to date and fully furnished in mathematics so far as the same has any philosophical import. His *Foundations of Mathematics* deals with the questions now most in gestation in a way and with a mastery that the mathematicians can ill afford to neglect. In particular the three cardinal conceptions of anyness, uniquity and even boundaries are therein, so

far as I am aware, first put forward and exhibited in clear relief as the most significant and consequential ideas that contribute to the foundations of mathematics.

* * *

To my mind it is the calamity of geometry that it falls down at its very start in not providing a thoroughly competent definition of the straight line. The conception is pervadingly necessary everywhere in mathematics. All things in mathematics have been made by it, and without it has not been made anything that has been made; and all the modern questions concerning the foundations of geometry—the nature, origin and meaning of axioms and the like—are embarrassed to the point of insolubility simply and solely by reason of the lacking definition. I hope, therefore, I shall be pardoned on account of my good intentions, if for nothing else, when I offer for scrutiny and judgment a definition which so far as I know is a new one and seems to me to depend upon nothing experiential in its nature except the unalterability of the interval. I show, I think, how the ruler may be derived by means of the compass alone. As an introduction consider the figure following:



It is constructed thus: Take any two points, say A and

B. With, say, A as a turn-point (it might just as well have been B) and with the interval AB as the compass opening, scribe the circle Bx_1 x_2 etc. clear around complete. Then with B as turn-point and with *any* opening of the compass, short of 2AB, mark off on the first circle two points, say x_1 and y_1. The same will be, of course, at equal intervals from B. Then from each of the points so marked scribe circles with the compass opening the interval AB. Such circles will all pass through A, but besides that they will otherwhere intersect and determine a point as, say z_1. Now for each possible pair of points thus determined on the first circle, there will be thus determined by the circle intersections lastly above mentioned a point, and each and all of these last mentioned points *will lie in a straight line.*

But stop! I have been talking as though I assumed the plane to be already earned and known, and until we duly and geometrically earn the plane we have no geometric right to use it. I have employed my figure and my comment thereupon just to lead the imagination a little so that it will easier picture and understand the real figure I desire to use, which cannot be drawn upon paper.

I now say, Take any two separate points, say A and B. With either of them, say A, as a turn-point and with the interval AB scribe a *sphere.* Then from B as a turn-point and with any interval short of 2AB scribe any secondary *sphere.* The infinitely numerous thus possible secondary spheres will each intersect the primary sphere in a curve (in fact a circle). On any such curve select at random any triad of separate points, and with each so selected point as a turn-point and with the interval AB as radius scribe tertiary spheres, three in all. Such tertiary spheres will all pass through A, but they will besides at another place intersect in and determine a point. Now for each of the infinitely numerous point triads prepared for and

selected, as I have prescribed, there will be thus determined a single and *unique* point, and all these so determined and last mentioned points will lie in a straight line. The limited straight line so formed or rather the infinitely numerous array of points thus determinable and that stud the line, I call The Straight Range, and it is easy to see that it will be 4AB in extent.

I define it thus: The Straight Range is a continuous linear array of points such that any point of it is separated from each one of some triad of separate points by a common interval X and each one of said triad of separate points is at once at the interval X from one of a pair of points that are separated by the interval X and at a common interval Y from the other one of said pair of points.

No doubt a draftsman would have to be eminently expert to locate some of the points with precision, but that does not much detract from the scientific value of the construction.

Just as we center the primary sphere at A so we may also center the same at B and proceed to construct a range in all respects similarly as when A is taken. The two ranges will perfectly coincide as to three-fourths of their several and respective extents and so all but the extreme ends of the combined range 5AB will be perfectly determined even for the draftsman.

The chief use of the straight range construction is the insight or atsight it gives us as to the nature of the straight line. It enables us to see just what it is that is the essence of the straightness of the straight line, viz., the perfect uniquity of any point of any triad of points upon it in respect to the joint pair of intervals that separate it from the other points of said triad of points. It is the *only point that exists* that has at once and jointly those intervals. So I define the straight line as follows:

I first define *The Straight Point-Triad* thus:

The Straight Point-Triad is a triad of points such that any point of the triad is the only point that exists that has together at once the same pair of intervals that it has from the other points of the triad respectively. Then:

The Straight Line is a line such that any triad of points upon it is a straight point-triad.

Suppose we now venture to define the plane by its points. Conformably with the above definition I would say that it takes four points to define a plane, and I would first define the plane point-tetrad thus:

The Plane Point-Tetrad is a point-tetrad such that no point-triad of it being a straight point-triad any point of it is the only point that exists that together at once has the same triad of intervals that it has from the other points of the point-tetrad respectively.—Then:

The Plane is a surface such that any point-tetrad upon it that has no straight point-triad is a plane point-tetrad.

Plane point-tetrads divide into two sorts according to whether one of the points is within the plane opening between the other three points, or whether no one of the points is within said opening. Call the former sort *close* plane point-tetrads and the latter sort *convex* plane point-tetrads. In every close plane point-tetrad say, $a\ b\ c\ d$, where, say d is the point within the others, there exists for each of the latter a point x_n such that $a\ d\ x_1$, $b\ d\ x_2$ and $c\ d\ x_3$ will all of them be straight point-triads. In every convex plane point-tetrad the other points stand with relation to any one of them as adjacent points two in number or as a single opposite point, and a single point y *exists* such that it forms with the adjacent points a straight point-triad and with the opposite points another straight point-triad. But I have not yet put together enough of "The Elements of Compass Geometry" to make it worth while to pursue here whither it will lead. But I hope I am not mistaken in my faith that geometry depends at last upon

one non-subjective datum alone, to wit: the invariance of the interval, and I furthermore avow my faith that this datum is indispensable, ineluctable.

Prof. Cayley showed that everything in non-Euclidean geometry could be perfectly presented in ordinary Euclidean space (as it is called) by suitably varying the notion of distance. But the necessity of the fixed unalterable interval as a foundation is not thus to be surmounted, for variation itself has no meaning, norm or description when it lacks the basis and background of the invariable interval.

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CRITICISMS AND DISCUSSIONS.

IN HOW FAR WAS BEL THE CHRIST OF ANCIENT TIMES?

Whoever has had any acquaintance with Dr. Radau and his writings need scarcely be told that his little book, *Bel, the Christ of Ancient Times*,* like his other works, is packed to overflowing with Sumerian grammatical criticism and information and is, on that account alone of value to any student of that cryptic and most ancient of languages. We will grant indeed that he is one of the greatest, perhaps even *the* greatest living authority upon it.

Yet the title is perhaps misleading to many prospective readers. For such may possibly imagine that the intention is to prove the Christ of Catholic belief merely a latter-day replica of Bel, the heathen god, long outworn!

But the object is widely different. And while we may not follow the author in many of his arguments, yet the general conclusion is the by no means startling one, that the men of ancient Babylon felt the very human need for comfort and hope amid the ever present grim facts of suffering and death, and thus created for themselves in their own image, as they must needs have done, a redeemer who should conquer death and hell and bring to weary souls redemption and immortality.

This, we say, is both as it should be and as it must be in all ages and among all races. The Egyptians had Osiris, their suffering redeemer. Greece and Rome had the Orphic and Eleusinian mysteries and Mithras. The Aztecs, the Incas, and the primitive American Indians all had quite similar faiths. And were we to hereafter discover a hitherto unknown hyperborean race, we may be confident that whatever philosophy and religion they may have created, will be along these age old lines. For its roots lie, ineradicably, in the fundamental needs and aspirations of man.

* Chicago: Open Court Publishing Co., 1908.

And it is a familiar commonplace of Catholic theology, that it was this universal desire for and expectation of the Man-God Redeemer, that imperatively demanded and necessitated its fulfilment in the Incarnation of Him, who was "the Light that lighteth every man that cometh into the world"; and the "Desire of all nations." So that here as in lesser cases prophecy, whether heathen or "revealed," was merely insight into what by dire necessity had to be. And Christianity, therefore, is not, as Puritanism heretically conceived, an artificial "scheme of salvation," foisted upon an unwilling and utterly alien world. But is, on the contrary, the *Catholic faith,* which summarizes, completes, and makes secure all the various partial broken insights and wavering desires for good, in the heathen religions and philosophies; which heathen faiths are indeed, by their very nature, nothing more than the instinctive gropings of men after truth and God, if "haply they might find Him." They had faults and defects; unquestionably, many and obvious. But these, in nearly every case, were simply the defects of imperfect insight springing from the unavoidable limitations imposed by racial capabilities and environment. In short, they were "right in their assertions, but wrong in their negations." So that Christianity comes, as the Catholic faith, not to destroy, but to *fulfil,*—and to fulfil not merely Judaism, but all the other ethnic beliefs; and only supersedes, because it so fulfils.

Hence, not only Bel but all the gods of the elder world were in a very real sense the "Christs" of their several times. And, in each and every case, much of their mythology and doctrines can be paralleled by something in Christianity,—indeed, must be paralleled, if that is to be the final truth.

But to turn this the wrong way about as some may seek to do, and claim that Christianity is therefore nothing better than a revamped Babylonianism, or Buddhism, or Parseeism, as the case may be, is surely to woefully misread the story! It is quite as if some one claimed that the events in American history were by no means new, but were word for word, and act for act, not merely similar in some respects to, but identical replicas of the words and events in Babylonia 8000 years ago!

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BOOK REVIEWS AND NOTES.

PARALIPOMENA. REMAINS OF GOSPELS AND SAYINGS OF CHRIST. By *Rev. B. Pick.* Chicago: Open Court Publishing Co., 1908. Pp. 158. Price, 75c.

This book contains: (1) in eleven chapters remains of extracanonical gospels; (2) some important gospel-manuscript readings; (3) scattered gospel-sayings from different sources; (4) an appendix giving the Apocalypse of Peter and a complete bibliography on the matter treated. For him who wishes to become acquainted with the remains of extracanonical gospels and sayings of Jesus this short work will be very instructive. He will be astonished to find how up to about 220 all the noted ecclesiastical writers made use of the extracanonical gospels and sayings of Jesus in the same way as of the canonical, showing that up to that time no distinction was made between canonical and apocryphal. We first notice it in the time of Origen (d. 254). We see that Clemens Romanus, Papias, Justin Martyr, Athenagoras, Hegesippus, Irenaeus, Clemens Alexandrinus, Tertullian largely cite from apocryphal sources and give them credence. We also notice that some extracanonical gospels stand very near to the time of the canonical, perhaps some even date from the same age. It is a question whether, if one reads these remains and sayings with an unprejudiced mind, he would find any greater crudities, absurdities and incredibilities in the apocryphal gospels than in the canonical. The writers of the former had the same right to treat the traditional matter about Jesus in their way, from their own standpoint, to suit the views of some particular sect or party, as did the so-called canonical gospel-writers, who likewise wrote to suit different views and different parties. That so little has come down to us of the apocryphal gospels, is probably due to the relentless attitude of the growing Catholic Church to suppress all so-called heretical writings. If we had all the extracanonical literature which is lost, we would get a truer picture of the origin of Christianity and the rivalry of the different parties in it from which later rose the domineering Catholic Church, which then arbitrarily declared what was canonical and not canonical. We therefore gladly welcome all that we can get of the earliest apocryphal Christian literature. It would have been very interesting if Mr. Pick had also taken up in his work the so-called Protevangelium of James, whose main elements also date from the second century. From this gospel we would have seen how the literature on the infancy of Jesus and his birth by a virgin, begun by Matthew and extended by Luke, developed into literature, which not only made Mary conceive as a virgin but remain a virgin to her end, the beginning of all the later Mariolatry.

It is interesting to read in Mr. Pick's book in the so-called "Preaching of Peter," considered authentic by Clemens Alexandrinus, and already made use of by Aristides in his apology to Hadrian according to Hennecke, (*Neutestamentliche Apokryphen*), that Jesus commanded his Apostles not to depart from Jerusalem for twelve years and that according to the Codex Askew.: "Jesus, after his ascension descended again to earth and for eleven years, instructing his disciples, etc." From this we see that the great discrepancies already existing in the canonical gospels concerning the resurrection of Jesus and the time of his sojourn with his disciples till his ascension, became more widened yet in apocryphal literature. This reminds me of the early epistle of Barnabas, which makes Jesus ascend the same day on which he arose from the grave, while according to Harnack some ancient Christian writers place 18 months between the resurrection and ascension.

Important in the appendix are the remains of the so-called Revelation of Peter, which, according to the Canon Muratori (end of the second century) were received in the Church with the canonical Apocalypse of John, as giving a horrible imagery of hell and its torments developed beyond the already strong colors of the canonical writings in this respect. We beg to differ though from the statement on p. 118 and think that the apocalypse of Peter stands in close connection with the fearful descriptions of hell in the pre-Christian Judaic Book of Enoch, based on earlier Oriental descriptions of hell from which very probably also the Orphic-Pythagorean Hades-books of the Greeks have descended.

While looking up a reference to Eusebius on p. 96 I noticed an error. Instead of Hist. Eccl. V, 18, 14 it should read V, 21, 14.

A. Kampmeier.

Modern Classical Philosophers. Selections Illustrating Modern Philosophy from Bruno to Spencer. Compiled by *Benjamin Rand, Ph. D.* Boston: Houghton, Mifflin, 1908. Pp. 740.

This book is practically a history of philosophy, but the attempt has been made to apply to the realm of philosophy the case system which is so successful in the teaching of law. That is to say, instead of giving a resumé of the different systems it gives carefully edited selections from the original works or translations of them. It is a valuable work, well executed, and provides the general reader with a volume from which he may readily discover the content and method of the great philosophical masters of the modern period. "Beginning with Bruno, the philosophical martyr, the dialogue which appears in this work is one in which the author describes the unity and divine immanence in all things in the universe, thereby anticipating the doctrine of Spinoza. From Bacon has been selected an account of 'the idols' or false notions which hinder men from a right pursuit of scientific research, and of the theory of induction by which they may advance in a true interpretation of nature. The passages from Hobbes contain his doctrine of the natural state of man as one of war, and of the necessity of 'that great Leviathan,' whereby peace and order may be established in the political commonwealth. Of Descartes, a part of the 'Discourse on Method' is printed first, since it contains

his intellectual autobiography and his peculiar principles of method for the attainment of truth; a transition is then made to his 'Meditations on First Philosophy,' to set forth the application of his method of doubt to the discovery of absolute certainty, and also his attempt to demonstrate the existence of God. From 'The Ethics' of Spinoza are given the doctrines of his one eternal substance as the immanent cause of the universe, of his three kinds of cognition, and of his intellectual love of God. The 'Monadology' of Leibnitz is reproduced in full."

Thus in his preface the editor enumerates what parts he has utilized, passing on further to mention chronologically Locke, Berkeley, Hume, Condillac, Kant, Fichte, Hegel, Schopenhauer, Comte, Mill and Spencer.

CONCEPTS OF MONISM. By *A. Worsley*. London: T. Fisher Unwin, 1907. Pp. 356, Price 21s.

This book is not quite what it seems. The Author understands by monism a philosophy which claims "that there can be but One Source from which spring all things, both real and imagined (p. ix). Thought is mainly shaped by a study of Brahman monism which he mainly derives from the translations and commentaries of Max Müller. He prefers to discuss these Chinese exponents of monism for the reason that they are little known in England. He says (p. viii):

"I deal at some length with the Idealistic Philosophies of India, because they seem to rest upon an almost unassailable basis; and also because the importance of these systems has not generally received due recognition from British authors. On the other hand, the Idealist systems of southern Europe are so well known to our philosophers that no possible benefit could accrue from restating them.

"On the Empirical side, the modern Monistic system, so ably expounded by Haeckel, has absorbed every argument that has been deduced from Subjective Knowledge, so that it is unnecessary to recontrovert those systems which he has irrevocably overthrown."

Haeckel's ideas are scattered over the book, without however modernizing the author's love of the Orient to any extent. He works into his system some views of Renan, Ostwald, Hume, Schopenhauer, Berkeley, Du Bois-Reymond and others who somehow or other are sympathetic to him, and the idealistic monism of the Brahman philosophy is enriched by a study of Lao-Tze and Confucius. Upon this foundation our author builds his philosophy with a considerable breadth of mind which as is well known is quite in keeping with his authorities. The work which Vignana Bhikshu did for the old orthodox Brahman philosophies Mr. Worsley has attempted to do for philosophy as a whole. He says:

"If Vignana Bhikshu could discern an underlying unity in all the orthodox Brahmanic philosophies, is it not given to us to discern the unity of all philosophy? I say that it is. That although no system has reached the Truth, the Absolute, yet that every philosophy has had some vision of That One. Some have seen more than others; some have seen much, but indistinctly, others have seen little, but clearly. In some cases what was clearly seen by earlier

sages has become dimmed and blurred to our later vision; in others doubts have been dispelled and difficulties overcome. Therefore it is that I have striven in this system of Monism to build upon the foundation of Knowledge common to all the greatest philosophies. When all demonstrable errors have been eliminated, and the comparison has been accomplished, I claim that something remains to be distilled from every philosophy and every religion."

Mr. Worsley is not hostile to the views which he has left behind. He recognizes them as errors. He gives up the Christian idea of a personal God and a heaven beyond the clouds, and accepts in its place a supreme spirit and a beyond of preeminently Vedantic conceptions. He says:

"We must not forget that when, in the search for Truth, we leave behind the World of alleged facts, we leave also a vast array of necessary and unnecessary attendant Errors. For our senses, as in a mist, darkly, give us at best but transitory and faulty impressions within the field of subjectivity. But the Mind may see, by the light of Pure Reason, beyond this veil of the Material, into a great Beyond where Object and Subject cease to mirage each other in distorted duality, and become simply a phase, an idea."

How constructive his imitations are appears from the following passage:

"To Monists there can clearly be no such active personal God as is worshiped by believers in revelation; no Good or Bad, nothing either praiseworthy or blameworthy in any transcendent sense; for there can be no absolute sanction for relative perceptions. But on the other hand Monists admit the possibility of all moral and of many religious concepts as being beneficial, necessary, and even relatively true. Their philosophy does not close the door against any devout person, but rather calls upon him to clearly realize that we can have no absolute sanction for any action whatever, and that the values of all moral teachings must be gauged, not by any absolute standard, but rather by their effects upon humanity. To this extent actions may be good or bad, praiseworthy or blameworthy, and the Gods of Religion or the Isvaras of Philosophy are good too, if, by any such process of imagery, benefits result. Hence those who have so read this book as to deem Monism a destructive, rather than a constructive, philosophy, have misconceived the plan of my work."

Die Weltanschauung Spinoza's. Von *Dr. Phil. Alfred Wenzel.* Leipsic: Engelmann, 1907. Pp. 478.

In his preface Dr. Wenzel explains that it is quite an accident that he became enough interested in Spinoza to undertake an extensive investigation into his world-conception. It was at the time of a severe illness that he renewed his acquaintance with Spinoza's writings, and he says that the old charm worked anew, and he soon realized that in the extant works of this great man and thinker there lay an inexhaustible balm of blessings and comfort for the soul of the matured man of to-day. In his convalescence he undertook a further study of Spinozist writers and critics, and was astonished to find that he stood practically alone in his conception of Spinoza's system, and that in spite of a large amount of literature that had been written on the subject, the views of the later authors often differed very widely on the most important questions of Spinoza's teachings. He found himself almost completely in

sympathy with Friedrichs's *Der Substanzbegriff Spinozas* (Greifswald, 1896), but for this very reason it seemed the more remarkable that this writing which to him stood out as a landmark among many others should apparently have received only a slight consideration from the public. Greatly to his regret he learned that the author has never finished many of his Spinoza studies to which he refers in his one publication, and so they have never become accessible to the public. If he had completed his work on the lines in which he began, Dr. Wenzel would have considered a comprehensive work by himself as superfluous, but it is just because of this lack that he has undertaken the work, of which the first volume lies before us.

A comprehensive work on the world-conception of Spinoza which does not start out with his substance and attribute theories, is indeed a rarity in Spinoza literature, but Dr. Wenzel accounts for this omission by referring the reader who wishes to confine his interest to these subjects, to the above-mentioned book of Friedrichs, which practically gives the author's own views. His reference to these important phases of Spinoza's philosophy he has preferred to give in close connection with his exposition of Spinoza's epistemology and ontology, so that the important subject of Spinoza's God-conception might be the central point of the entire study around which the other theories group themselves in their proper relations.

After an introduction dealing with Spinoza's historical position and significance for the philosophy of to-day, Dr. Wenzel treats in Part II of Spinoza's conception of God and human knowledge; while Part III discusses his God-conception with relation to the nature of things. In his effort to give a name to the philosophy of Spinoza, Dr. Wenzel would call it a "naturalistic, panlogistic pantheism." He says: "Spinoza's system is *pantheistic,* because God, that is to say the world-ground or substance, must be thought of as immanent in the world of experience. It is *naturalistic* because this world of experience is enacted in individual instances in the form of a mechanical causality of nature, which is just as determinative for immaterial as for material events. It must be called *panlogistic* in so far as the whole world of experience must be considered with relation to its connection with and its unity in God, as the expression of an eternal power and law of intelligence which is identical with the absolute activity of God." There is no indication in this first volume as to what the second will contain.

Aspects of Kinetic Evolution. By *O. F. Cook.* In *Proceedings of the Washington Academy of Sciences.* Vol. VIII, pp. 197-403. Washington, 1907.

O. F. Cook, of the Agricultural Department of Washington, publishes in the *Proceedings of the Washington Academy of Sciences,* an essay entitled "Aspects of Kinetic Evolution," in which he proposes some new views on the evolution theory. He presents some new aspects along the lines of modern research which are to some extent akin to the investigations of Professor de Vries and other naturalists. The opening sentences of his first chapter characterize his idea of the kinetic theory as follows:

"The kinetic theory of evolution finds in the facts of organic development indications that the characters of species change spontaneously, or without en-

vironmental causation. Evolutionary progress is further conceived as accomplished through the union of the normally diverse individual members of species into a coherent network of interbreeding lines of descent, rather than by the isolation of variant individuals or by the selective restriction of descent of individuals possessing particular characters.

"Former theories have undertaken to explain the method of evolution by reference to the dendritic figure of descent as shown in the ever-branching relationships of species, genera and families. The kinetic interpretation of the evolutionary process is based on what may be called the intraspecific figure of descent, the relationship of organisms inside the species, which is reticular or net-like, and not tree-like.

"Theories based on the dendritic conception of descent may also be described as differential; that is, they have given attention chiefly to the problems of distinction and separation of organic groups. The kinetic theory is integral or synthetic, and conceives the evolutionary process as conducted by the accumulation and combination of the variations which appear among the members of the species.

"The simple distinctions are fundamental, and will necessitate an extensive readjustment of methods of thought and investigation in the field of evolution."

La philosophie sociale de Renouvier. Par *Roger Picard.* Paris: Marcel Rivière, 1908. Pp. 330. Price 7 fr. 50.

In this book the author undertakes to present very objectively the many original theories comprehended in the entire domain of law and sociology and which in the system of Renouvier are closely connected with purely philosophical questions. It is his intention to show the bond which unites Renouvier's philosophical thought with his political and social thought, and he makes clear how that philosopher has been able to give in a quite original method exact solutions to problems which arise from social life. It is particularly interesting to follow the author in his exposition of the political doctrine of the philosopher, who after having analyzed the ideas of state and democracy deduces therefrom the duties which devolve upon a Republican nation. Purely social questions such as property, salary, capital, and labor-organizations, are investigated and are solved by the application of ethical rules, to the exposition of which the first part of the volume is devoted. This work is a faithful picture of a system perhaps too little known. This it will make accessible to many who can not read the enormous work of Renouvier.

Rosmini. Par *F. Palhoriès.* Paris: Felix Alcan, 1908. Pp. 387. Price, 7 fr. 50.

One of the latest of Alcan's series of great philosophers is this study of Rosmini. In this one volume is condensed the voluminous works of the celebrated Italian, divided in the same divisions which he himself has made,—ideality, reality and morality. With regard to Rosmini's most characteristic theories, M. Palhoriès takes a careful and judicious position. In conclusion he sums up the sources of Rosmini's philosophy, showing its relation to Plato, Leibnitz, Malebranche, Kant and Hegel.

RUDOLF EUCKEN'S PHILOSOPHY OF LIFE. By *W. R. Boyce Gibson.* London: Adam and Charles Black, 1907. Pp. 182. Price, $1.40 net.

Professor Eucken takes a prominent place among philosophers of to-day, and Mr. W. R. Boyce Gibson has taken upon himself the task of condensing Eucken's philosophy of life into a comparatively small volume. In the several chapters which were originally delivered as lectures at Westfield College, University of London, in 1905, he reviews the essential doctrines of philosophy as presented in Eucken's successive books, and though a great admirer of the philosopher, he criticises his views in the last chapter. Eucken's philosophy insists mainly upon the spirituality of the world, and in doing so he criticises materialism as it is represented, for instance, by his famous colleague, Prof. Ernst Haeckel.

WIRTHSCHAFTLICHE GRUNDLAGEN DER MORAL. Von *Franz Staudinger.* Darmstadt: Roether, 1907. Pp. 160.

Franz Staudinger, of Darmstadt, explains in this volume his ideas of morality as based upon social and economical conditions. He condemns the principles of lord-morality as preached by Nietzsche and acted upon by the ruling classes, recommending in its place the socialist morality as the higher ideal. He points out that the actualization of this aim will finally prove to be a question of power which has to be decided by a struggle between the classes, but he grants that ideals must always remain ideals, and we doubt whether the new order of society which he foresees will be an improvement upon our present conditions.

L'INDIVIDUALISMO NELLE DOTTRINE MORALI DEL SECOLO XIX. Dal *Giovanni Vidari.* Milan: Ulrico Hoepli, 1909. Pp. 400. Price, 6.50 l.

This essay received the successful award in the competition held before the Royal Academy of Moral and Political Science at Naples in 1906, though its publication has been delayed in order to give opportunity for continued study and because of various personal contingencies. In his discussion of "Individualism in the Ethical Teachings of the 19th Century" the author treats in his introduction of the relation between individualistic and anti-individualistic theories, and gives some introductory definitions with regard to the conception of individualism and its theories. The first chapter dealing with individualism of rationalistic theories discusses in detail the Catholic anti-individualistic movement, and then the individualism of Maine de Biran, Benjamin Constant, Victor Cousin, Guizot, Proudhon, Renouvier, Amiel, Renan and others. In the second chapter on individualism of empiricism, Paine, Godwin, Bentham, John Stuart Mill, Spencer, and Haeckel are enumerated and their relation to individualism is discussed. The third chapter deals with the individualism of the instinctive theory as represented by Schiller, Novalis, Coleridge, Carlyle, Emerson, Ibsen, Nietzsche, Kropotkin, Tolstoy and others. The fourth chapter considers the general validity of these theories.

The *Hibbert Journal* of July (Vol. VI, Number 4), 1908, contains an article on "Pluralism and Religion" by Prof. William James, in which he

continues to preach his peculiar kind of pragmatism which he serves by rejecting the "authority of intellectualist logic." By renouncing this logic he rids himself of "the intellectual difficulty," but of course surrenders at the same time the only method of systematically arranging the data of experience, and so falls into the bottomless pit of pluralism. He says:

"We may be in the universe as dogs and cats are in our libraries, seeing the books and hearing the conversation, but having no inkling that there is any meaning in it all. The intellectualist difficulties fall away when the authority of intellectualist logic is undermined by criticism, and then the positive empirical evidence remains. The analogies with ordinary psychology, with certain facts of pathology, with those of psychical research, so called, and with those of religious experience, establish, when taken together, a decidedly formidable probability in favor of a general view of the world almost identical with Fechner's. The outlines of the superhuman consciousness thus made probable must remain, however, very vague, and the number of functionally distinct "selves" it comports and carries has to be left entirely problematic. It may be polytheistically, or it may be monotheistically conceived of. Fechner, with his distinct earth-soul functioning as our guardian angel, seems to me clearly polytheistic; but the word polytheism usually gives offence, so perhaps it is better not to use it. Only one thing is certain, and that is the result of recent criticism of the absolute: the only way to escape from the paradoxes and perplexities that a consistently thought-out monistic universe suffers from as from a species of auto-intoxication (the mystery of the "fall" namely, of reality lapsing into appearance, truth into error, perfection into imperfection—of evil, in short; the mystery of universal determinism, of the block-universe, eternal and without a history): the only way of escape, I say, from all this is to be frankly pluralistic and assume that the superhuman consciousness, however vast it may be, has itself an external environment, and consequently is finite. Present-day monism carefully repudiates complicity with Spinozistic monism. In that, it explains, the many get dissolved in the One and lost, whereas in the improved idealistic form they get preserved in all their manyness as the One's eternal object. The absolute itself is thus represented as having a pluralistic object. But if the very absolute itself would have to be a pluralist if it existed, why should we hesitate to be pluralists out and out? Why not straightway adopt the absolute's form of vision on our own account, and refuse to envelop our many in the One that brings the poison in its train?

Professor James's view of monism must be very very strange, and I suspect that he does not understand that systematic method and clearness of thought do not involve a rigid unity nor do they abolish the multiplicity of phenomena and the concrete world of facts. It is difficult to say how the world is mirrored in his head, but there can be no doubt that he will fall a prey to mysticism. Like so many other reformers who find difficulty in the problems of modern thought and civilization, he unconsciously follows the motto, "Back to the days of savagery," and the ingenious way in which he upholds his case elicits our admiration. We are rather astonished, however, to observe the enormous success of his philosophy among professional or so-called professional thinkers, which indicates that the majority of them are still in a state of naive immaturity.

The Philosophical Review contains an article by Prof. John Grier Hibben, of Princeton University, entitled "The Test of Pragmatism," which deals critically with the subject. Professor Hibben concludes his article as follows:

"We may regard ourselves as artists in the composition of the truth, but hardly as creators.

"As to this constant factor, which appears in every problem confronting our thought, Professor James thinks that it is one that is being gradually formed by us. As to the unity which seems to underlie the world of our experience, he insists that it is only a possible empirical unification, the *terminus ad quem* of our constructive thinking. The world, however, is not merely approaching unification,—that 'far off *human* event, towards which the whole creation moves.' Too many elements are combining, too many lines are converging towards the same point, for us not to think that there is something behind as well as before this onward movement. There must be a unitary ground, if there is to be a unified goal. And there is much to be said in defense of the old scholastic formula, that what is last in execution must be first in conception. This may describe the programme according to which the history of the world as a whole has unfolded, as well as the manner in which the individual orders his single life. We are not in a 'closed and finished universe,' it is true; but, on the other hand, we are not in a universe which is solely of our own making. We are in a universe which, while in the making, is nevertheless unfolding according to the laws and trend of its own potentialities. And if we believe that certain ends will be realized ultimately, and the complete unification of the whole finally disclosed, may not the consummate reality have been from the beginning, even though in a potenial form? And so far as the universe is fashioned by human touch, is it not our primary task to understand the truth of things as they are, so that we may the better realize the truth of things as they ought to be?"

Hermann Strack has published a new and thoroughly revised edition (the fourth) of his "Introduction to the Talmud" (*Einleitung in den Talmud,* Leipsic, Hinrichs, 1908). He has neither the intention to criticize nor to write an apologetic treatise, but wishes to serve the truth. He only denounces vigorously the idea that the Talmud contains passages which are not accessible to Christians possessed of the necessary information.

The book contains an exposition of the history of the Talmud, its parts and treatises, an alphabetical index of its contents, the Palestinian and the Babylonian Talmud, the Extra-Canonical Treatises and Chronological Lists of its authors and description of the character of the Talmud, and finally samples of the text in German translation. The book will prove useful to all interested in Talmudic lore and is published by Hinrichs as the second instalment of the publications of the Institutum Judaicum in Berlin.

American theologians who may have met Prof. Carl Clemen of the University of Bonn, will be interested to know of the appearance of a book from his hand, containing 300 pages, and bearing the title *Religionsgeschichtliche Erklärung des Neuen Testaments,* published by Alfred Töpelmann (formerly

J. Ricker) Giessen, 1909 (Price, 10 m.). It treats the problem of the dependence of primitive Christianity upon non-Jewish religions and philosophical systems. The first "general" part treats of Christianity as a whole and then of special doctrines, viz., the doctrine of God and intermediate spiritual beings, of the end of the world and of life after death, of the ideas of justice and sin, all of which is already contained in Judaism. Then he treats of the new views, the personality of Christ and the trinitarian formulae, ritual worship and the Church institutions of baptism and the sacrament.

The second "particular" part treats of the life and doctrine of Jesus, the story of his infancy, his baptism and temptation, his ministry, his passion and resurrection.

Further he treats of the Pauline theory, and finally the Johannine literature.

It is a symptom of the times that a number of enterprising publishing houses are coming to the front simultaneously with dictionaries of the Bible. Some time ago the field was monopolized by the ponderous encyclopedia of Herzog, which existed for a long time only in its German original, while in England the Bible Dictionary of Smith was current in three editions: a large one for theologians, a medium-sized one for students and clergymen, and a small one for Sunday-school teachers and young people in general. Afterwards two other English works came to compete with Smith, the *Encyclopædia Biblica* in four volumes, and the so-called Hastings *Dictionary of the Bible,* of which the former was suspected in orthodox circles as heretical. Within the last year three new publications have appeared on the basis of the old ones and make the enormous material of Biblical knowledge accessible to the general public. We announced the first volume of the *New Schaff-Herzog Encyclopedia of Religious Knowledge* in the October number of *The Monist,* and will add that at present the second volume lies before us in style and scholarship the equal of its predecessor. We have announced in the March *Open Court* the *Standard Bible Dictionary,* edited by Jacobus, Nourse and Zenos, a work mainly of American scholarship; and now there lies before us the one-volumed *Dictionary of the Bible,* edited by James Hastings, D.D., with the collaboration of John A. Selby, John C. Lambert and Shailer Mathews. In this work the influence of English scholarship prevails, and it may be regarded as the expression of a scientifically trained, but at the same time conservative, theology represented by its editor-in-chief, James Hastings, who is the editor of the *Expository Times.*

The entire volume comprises almost a thousand pages and it has been the editors' intention to offer their readers the whole material as complete as possible in a most condensed form. This work contains approximately the same number of pages as *The Standard,* but by using a smaller type and no illustrations, it is able to compress more material in the same space, and care is taken that the great subjects should not be treated with that excessive brevity which so often makes single-volumed works of reference so disappointing; e. g., 24 pages have been allotted to the subject of "Israel." As the scope of the work is simply popular, Hebrew and Greek words are used only in transcription. All articles are signed by the full name of the author.

VOL. XIX. JULY, 1909. No. 3.

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THE NATURE OF VITAL PROCESSES ACCORDING TO RIGNANO.

EUGENIO RIGNANO of Milan, Italy, engineer and student of philosophy, has recently published a book treating in an original and suggestive way the fundamental problems of biology.[1] In it are introduced some new conceptions which seem to point the way to the solution of many important questions, and which are intensely interesting at just the present stage of biological science. The extensive reference made to them by Prof. Francis Darwin in his presidential address delivered before the British Association for the Advancement of Science at their Dublin meeting last August, illustrates the growing appreciation among English-speaking scientists of the significance and value of Rignano's work. In this paper an attempt is made to present in English his fundamental hypothesis and some of its most interesting consequences and applications.

He has approached these problems in a somewhat different way from that of most authors who have written upon them. He was not primarily a biologist but a physicist. All his work shows evidence that he was a master of physical chemistry, and that he takes the keenest interest in scientific philosophy in general. He was led to the

[1] Eugenio Rignano, *Ueber die Vererbung erworbener Eigenschaften.* Leipsic: Engelmann, 1907.

study of biological problems by their vital relation to the results of other sciences and by their intrinsic interest from the standpoint of positive philosophy. Along these lines he has been an earnest worker, having contributed many thoughtful and scholarly articles to the *Revista di Scienza* and to other periodicals of a similar character.

Being attracted in this way to a consideration of biology, he devoted himself to a study of the facts presented by investigators and especially of the general conceptions developed from them by leading naturalists from Lamarck to the present time, a study, as his book clearly shows, of a most appreciative and discriminative kind. He found the general conceptions not wholly satisfactory and, sometimes, even contradictory of one another, and realizing that facts cannot be contradictory or misleading, he sought to see for himself the underlying basic principles which should explain and unify the facts, and at the same time perhaps indicate an outlet from the blind alley in which some biological inquiries at present find themselves stalled. In relation to the fundamental biological problem, that of the essential nature of the vital process itself, he found that "biologists are inclined to fall into two opposite extremes." He continues (pp. 359-361):

"Some deny flatly the possibility of ever arriving at a comprehension of the nature of life. But if we ask ourselves in what this comprehension of the nature of life could consist, from the point of view of positive philosophy, we have no difficulty in recognizing that everything must be reduced to comparing vital phenomena with some physico-chemical model already known, suitably modified by the particular special conditions imposed upon it so that just these special conditions shall determine the differences which exist between this vital phenomenon and that phenomenon of the inorganic world closest related to it. If this be so it is then the duty of science emphatically to

reject such a denial of scientific thought as would be constituted by the renunciation of this conception. Whether one clearly recognizes it or not, it is just this search for the nature of the vital principle which properly constitutes the principal object and the final goal of all biologic study in general.

"Others, again, are not willing to accord to life even the slightest property which should not be simply physico-chemical in nature. Among all these, it is enough to cite the example of Verworn who not only relegates assimilation to the category of purely chemical phenomena, by means of his biogenic hypothesis, but who would explain protoplasmic currents, the protusion of pseudopodia, the movements of cilia, and in general all movements of living beings by a double and alternative chemotropism of protoplasmic substance rather than by currents of nervous energy. Protoplasmic substance in fact according as it remains unstimulated or is stimulated, that is, partially decomposed by the stimulus which would agitate it mechanically, would possess a chemical affinity for the oxygen of the environment or for the substances produced by the nucleus capable of rebuilding the partially decomposed protoplasmic substance. And to this alternation of different affinities, the opposite protoplasmic movements of expansion and contraction would correspond.[2]

"Now it is evident that this endeavor not to attribute to vital energy any specific nature of its own, and consequently to explain even the most characteristic phenomena of life by means of only those energies which physics and chemistry afford us to-day, can have no more success than as if one should attempt to explain chemical phenomena by means of physical phenomena only. And this endeavor is also quite unjustified. For the conception that

[2] Verworn, *Die Biogenhypothese.* Jena: Fischer, 1903; and *Die Bewegung der lebendigen Substanz,* especially pp. 100-103.

the form of energy on which vital phenomena are based is different from all forms of energy which have hitherto been observed in non-living bodies, has absolutely nothing unscientific in it, any more than the conception, for example, that electricity may also be a form of energy different from all others.

"Vital energy, nervous energy, we admit at once, will certainly be a particular case of the more general physico-chemical forms of energy already known or yet to be known, and as such it must necessarily be subject to the laws which control these latter; and also, *a fortiori*, to the laws which control all energy in general. But even as such, that is as a particular case of more general, physico-chemical forms of energy, it will have besides further special laws of its own which are only experimentally to be determined and cannot simply be deduced from the more general laws even though it must always be subjected to them. And it is just these laws of its own which, out of a physico-chemical energy, make it vital energy. This conception has led us to attribute to nervous energy, set forth as the basis of life, special properties, which electric energy, in certain respects related to it, does not possess."

In accordance with this conception of the nature of vital energy Rignano developed a hypothesis of the fundamental vital processes which characterize all living matter. His theory is based upon well-known physical phenomena of electric energy; and by the hypothesis of certain specific qualities which this form of energy might be supposed to possess in the conditions existing in living matter, he has endeavored to account for the essential and distinctive properties of living matter. But such a conception, if it be true, must constitute not only a direct explanation of the fundamental properties which living matter always presents, namely assimilation, growth, and reproduction; it must also explain to some extent all the forms of activity

which vital energy ever manifests in biological processes, —polarity, rhythm, periodicity, mitotic division, fecundation, ontogeny with its recapitulation of phylogeny, atavism, heredity, memory, etc.,—the fundamental character of the vital process must be inherent in all these developments of it; a clear conception of their common basis must help us greatly to understand all of them, and must also tend to unify them, explaining their curious likeness to one another, as for instance the likeness of ontogeny and memory, so often observed, but so difficult to grasp and understand.

As one reads Rignano's book, and follows him in the consideration of one after another of these vital phenomena, and notes how harmoniously they accord with the hypothesis he suggests, the impression becomes steadily stronger that this is the line along which the final solution of the problem must be sought. Rignano does not claim that his suggestion furnishes the final solution, but submits it provisionally in the hope that it may serve to point the way to an ultimate complete understanding. He says (p. 387):

"We do not venture to offer this as a true and proper hypothesis. The phenomenon of life is still too little established for so bold a venture. We consider it only as a provisional scheme of the vital process which may serve as an initial concrete basis for further investigation into the nature of life. For in affording any firm provisional basis upon which the discussion of a question still entirely without solution can be supported, one attains always the great result of determining definitely the conditions of the question, of demonstrating clearly the untenability of certain views, which was not possible formerly while the question had yet too indefinite a form, and of bringing us in this way slowly but certainly nearer to a correct understanding of the phenomenon, in proportion as after dis-

carding the untenable propositions, the tenable stand out ever more clearly and convincingly and thereby are given firmer foundation."

In his book the author develops his hypothesis in an inductive way—proceeding from a consideration of ontogeny, but in this necessarily briefer review, it has seemed better not to follow the lengthy inductive method, but to state the theory at once in connection with one of the phenomena which it helps to explain. It might be presented in connection with any of the vital phenomena, since the fundamental process may be seen in all those built up upon it. A consideration of memory may serve as a good way of approach.

EXPLANATION OF MEMORY.

Explanations of this familiar but marvelous faculty have not been very clear or complete, but those who have developed any conception of its mechanism have been inclined to attribute it to some change in the material substance of the brain cells, produced by nervous currents passing to them.

Thus Hering states as quoted by Rignano (pp. 344-345): "We see how an entire group of experiences becomes reproduced in proper order of space and time, and with such vividness that it might deceive us as to the reality of what long since ceased to be present. This shows us, in a most striking way, that even after the sensation and perception in question has long since disappeared, there remains still in our nervous system a material trace, an alteration of the molecular or atomic connections by which the nervous substance is rendered capable of reproducing these physical processes by which the corresponding psychic process of sensation and perception is determined..... The representations do not last as representations but what does persist is that particular attunement of the nervous

substance, in virtue of which, when it is properly struck, it sounds again to-day the same note which it gave forth yesterday."[3]

"When we speak," writes Maudsley, "of a trace, vestige or residuum all we mean to imply is that an effect is left behind in the organic element, a something retained by it which disposes it to a similar functional act; a disposition has been acquired which differentiates it henceforth, although we have no reason to think that there was any original specific difference between one nerve cell and another."[4]

These conceptions constitute at best only an inadequate because indefinite explanation of the real problem of memory. The essential characters of this faculty are thus stated by Ribot. "Of the three elements of memory: the preservation of certain states, reproduction, localization in the past, the first two alone are necessary and characteristic." A true explanation must show definitely how these states are preserved, and how they are repeated. Rignano agrees with these conceptions in the belief that our specific sensations and perceptions are due to the passage through the nervous system of specific nervous currents, called forth by specific stimuli in the environment, and that the repetition of these specific sensations in memory depends upon specific changes induced in the nerve cells. But he goes farther, stating in his hypothesis (p. 344) what these specific changes in the nerve cells are.

"This something which leaves an impression after it in the nerve cell and which disposes it to other similar functional acts will be to our mind, a real and specific material residue of substance capable of reproducing the same func-

[3] Ewald Hering, *Ueber das Gedächtnis als eine allgemeine Funktion der organisierten Materie.* Vienna: Gerold, 1876, pp. 8, 9. English translation published by Open Court Pub. Co., pp. 7 and 9.

[4] Henry Maudsley, *The Physiology of Mind,* third edition, London, Macmillan, 1876, p. 270. Quoted by Rignano pp. 343-344.

tional current as that by which it had itself been deposited." These specific substances so deposited he calls specific mnemonic elements.

"In just this quality of being able to restore again the same specificity of nervous current as that by which each element had been deposited one would look for the cause of the mnemonic faculty in the widest sense....And further, the very essence of the mnemonic faculty would consist entirely in this restitution" (p. 342). This conception, it will be noted at once, is not very different from those already advanced. "The only new thing comprised in it is the hypothesis that the substance, whose discharge is thus able to generate a given nervous current, has been produced and deposited exclusively by a nervous current of the same specificity but of reverse direction, and could have been produced and deposited only by such a current. But in this hypothesis, simple as it is, lies everything; for it is just this which alone can explain completely the fundamental law of the reversibility of the relation between action and reaction, stimulus and impression, which governs all organic life" (p. 321).

Such specific elements do not, of course, permit of actual demonstration and their existence is purely hypothetical. The hypothesis is one, however, which is strongly indicated by the facts. Specific accumulations indicate specific accumulators, and these seem likely to be material and substantial since their activity depends upon nutrition, and the nerve cells containing them are material and substantial things. Rignano says (pp. 311-318):

"We should now examine a little more nearly this hypothesis....that the substance which constitutes each specific element, and which is capable of giving as discharge a single well-determined specific nerve-current, is the same and the only substance which this specific nerve current can in its turn form and deposit.

"This should not appear so very strange to us, since the inorganic world itself presents a phenomenon similar in certain respects. The substance which actually constitutes the charge of ordinary electric accumulators is capable of giving back inversely, during its discharge, the same kind of energy which it had previously received, and by which it had itself deen deposited, namely, the continuous electric current.

"The most important difference consists in this, that an electric accumulator is capable of restoring always only one and the same kind of energy, but not solely such or such specific mode of this energy, as, for example, only such or such intensity of current. It constitutes, for that reason, only a generic potential element; but such accumulators would attain the completeness of specific potential elements —receiving and restoring instruments of the greatest delicacy—if one could make it possible that each one of them should restore only a single definite intensity of current.

"The analogies and differences which nerve-currents present, in comparison with electric currents, quite warrant us in assuming in nerve-currents some of the properties of electric currents, and to attribute at the same time to the first other properties which the electric do not possess, provided these qualities are not incompatible with one another.

"It is known that, if we designate by E the electromotor force of an accumulator or of any electro-chemical generator, it can furnish currents of a given intensity i, according to the resistance R of the circuit, according to the equation $i = E/R$.

"Thus,—even though the terms of motor force, of resistance, of intensity, or more generally, of specificity, transferred from electric to nerve currents, must be quite vague,—we may very well venture, nevertheless, as preliminary hypothesis, to attribute to nerve-currents as

among the properties they might have analogous to electric currents, precisely those contained in this equation."

Rignano then goes on to state certain corollaries following from this hypothesis, which applying to the mnemonic process, account for certain of its characteristic phases.

"As it involves nothing incompatible with the properties expressed by this equation, we may imagine a nervous accumulator, constituted by a given substance, capable of being produced and deposited solely by currents of a definite intensity, or specificity, and at the same time capable of producing, by its decomposition, this current alone,—now from discharge and in the contrary direction,—of the same intensity or specificity i as that of the charge." This property exhibited by mnemonic elements would cause memories to produce the same sensations, and often also physiologic actions as were formerly produced in the original experience. "This accumulator, then, will discharge itself and produce this current as often as its nervo-motive force, which we may still call E, is sufficiently great to overcome the respective resistance, according to the equation: $E = iR$.

"Finally, we can assume that the magnitude of this nervo-motive force is proportional to the quantity or mass of the substance, which is gradually deposited and accumulated, as if the successive infinitesimal deposits of this substance were innumerable little Leyden jars arranged in relation, one to another, in some serial order. Then the greater the mass of the specific substance of this nervous accumulator the greater in proportion will be the resistance which its discharge will be able to overcome. At the same time, this accumulator capable of surmounting by its current of a predetermined intensity i, a given resistance R, will be capable also of surmounting every other resistance less great than R; for, for that, it will suffice that it

is not the total quantity of material at disposal that enters into action, but only a portion more or less large, so as to furnish for each resistance $R'<R$, the nervo-motor force $E'<E$, given by the formula:

$$E' = iR'.$$

"Suppose now that the discharge of this accumulator on account of the ubication or the mode of its insertion, is able to flow only upon a given point of a given plexus, traversed the length of its meshes by as many currents of the most diverse specificities, capable of combining one with another and of decomposing, and in dynamic equilibrium among themselves. (It may be remarked here that the expression 'dynamic equilibrium' of a circulatory system is always to be understood in the sense of inalterability for the time, in the conditions of movement at each point of the system. Thus, for example, the system of distribution of the drinking water of a city, which is fed from a given constant number of basins, whose head of water is maintained always at the same height, and in which a given constant number of water taps are always open, will settle in a short time into a dynamic equilibrium in our sense, and continue in it so long as the accession of a new basin, for example, or the opening of other water taps does not affect the transition to a new dynamic equilibrium.)

"As soon as the discharge of this nervous accumulator occurs, which can produce thus only a single definite specificity of current, and discharge itself upon only a single determined point, it will necessarily effect a single very definite change in the dynamic equilibrium of this given circulatory system. And in the cases in which this change of the dynamic equilibrium requires the doing of a certain amount of work (which theoretically is not always required), this required expenditure of work or energy will be definitely determined for each discharge, and can be

provided only by the accumulator itself. Consequently, in order that the discharge may take place, this quantity will have to be less than, or at most equal to, that which the accumulator can actually furnish.

"The quantity of work which each accumulator is capable of furnishing will necessarily be proportional to the mass of the substance which constitutes it. And since, as we saw, the resistance *R* which each accumulator with its current of definite specificity *i*, is able to surmount, is likewise proportional to the mass of the substance of the accumulator (because it is proportional to its nervo-motive force, which also is in its turn proportional to this mass, according to the preliminary hypothesis), then the quantity of work required to effect the change under consideration, must be regarded as equivalent to a resistance *R*, which opposes the discharge.

"If now we admit that in nearly all cases, which come into consideration here, the quantity of work, requisite for effecting a given change in the dynamic equilibrium of the whole circulatory system, is proportionately greater, the more considerable (if we may be pardoned this much too indefinite expression) in quantity and quality this change is,.... the following general rule can be established. The smaller the mass and therefore the nervo-motive force of a specific accumulator, so much the more closely is its discharge dependent upon the condition that the whole dynamic system, above all and very especially in the immediate neighborhood of the accumulator, find itself again in exactly the same circumstances in which it was when the accumulator was formed. Conversely, the greater the mass of the accumulator, the more easily can the conditions obtain which are able to effect its discharge." Consequently, if the mass, and hence the nervo-motive force of the accumulator, be minimal, it will be able to discharge only when the whole dynamic system in the immediate en-

vironment comes again into the same conditions practically as existed when the accumulator was formed.

"Let us suppose, further, that as the result of external influences there are induced at the same moment at a few points of the system a corresponding and equal number of new nerve-currents, specifically different from the preceding, so that the system is thereby caused to pass over to another dynamic equilibrium. It is clear that there will then be deposited in each point of the system—and not merely in those which external influences have directly modified,—a new specific potential element, in mass more or less large according to the time which the new state of dynamic equilibrium persists. At the same time, however, all these same points of the system will preserve, in a potential state—not in activation—, all the specific elements which were deposited during the preceding state of dynamic equilibrium.

"If, such being the state of things, it now happen that even any single point whatever of the system is brought back again, by any external influence, to the specificity which it already had possessed in the preceding stage, that will make it possible for the respective specific elements corresponding to that stage to come again into activity, at first in the point nearest, and then from next to next until in the most distant; for then each of these elements will find its immediate environs in approximately the same conditions as when that element was deposited and in activity. It will suffice then that even a single point of a system return, through the action of external influences, to its preceding state, in order that the whole system, transforming itself during the discharge of the different specific potential elements corresponding to that former stage, should resume the whole dynamic condition of that stage.

"We have then a phenomenon of succession or of asso-

ciation of nerve-currents which, as is easily conceivable and becomes even clearer later, may serve as a basis for the psychic law of succession or association of ideas."

This quality in nervous accumulators would explain how memories are recalled by association, how the memory of one part of a scene recalls the other parts, one after another, and how the memory of an event develops in our minds in the same sequence as was originally followed by the different parts of the event itself.

This specific potential mnemonic element or elementary nervous accumulator is "according to the hypothesis nothing else than the minute particle of a substance which each new specific nervous current, passing through a nucleus deposits in it, a substance which adds itself to those already present in it without changing them, and which is capable as soon as it finds itself in the same relation to its environment as at the time of its deposit, of restoring the same specific current by which it was produced." On pages 345-354 the author continues:

"The above-mentioned conception of Hering of the disposition of the nervous substance to sound again the tone of yesterday is derived from the physical phenomenon of acoustic resonators. The nervous substance which would be made to vibrate in a given specific way at a given point by a definite elementary sensation or representation would remain from that moment capable of vibrating always and exclusively according to that specific mode. According to the hypothesis of mnemonic elements on the contrary, it is well to repeat again each elementary sensation or representation would consist not so much in a specific vibration of the nervous substance at this or that point but in the production by the action of external stimuli of a given specific nervous current. In this way the memory of an elementary sensation or representation would consist only

in the reproduction by the action of causes now internal of the same specific nervous current.

"In other words the way in which the hypothesis of mnemonic elements or specific elementary accumulators would conceive of the mnemonic phenomena is as follows:

"A series of sounds or of words, for example a certain melody, or some phrase of a discourse when once it has entered by the ear we can imagine, produces a series of nervous currents in the auditory nerve specifically different one from another just as in a telephone the successive electric currents are specifically different from one another (in this particular case different in intensity) which the same series of sounds produces in the receptive apparatus and later transmits along the wire. If then one or several nerve centers, after receiving these specifically different currents, are capable of storing up these specific energies, each distinct from the other in such a way as to reproduce them identically later at the moment of discharge, and if, further, the discharge of each immediately preceding specific energy and it alone is capable of producing the liberation of the specific energy immediately following (and we have seen above that this is one consequence of the hypothesis of specific elementary accumulators), it will be in this way possible for the same succession of different specific currents and consequently of different ideas or impressions to be repeated a great number of times, and it is in just this that the mnemonic phenomenon consists.

"One could evidently say the same thing of the optic phenomenon, that is to say, of any series of colors or specific luminous vibrations which succeed one another in space or time.

"Ribot has rightly said that 'There is not one memory, but memories; that there is not one seat of memory, but particular seats for each particular memory.'[5] And, ac-

[5] Ribot, *Les maladies de la mémoire.* Paris, Alcan, 1901, p. 11.

cording to this theory, each mnemonic element would constitute a particular seat for each elementary sensation or each particular specific impression.

"In this sense also, that is to say on the condition that the expression 'nervous elements' be not disjoined from the conception of elementary specific accumulators or mnemonic elements, we can accept the idea of memory which this investigator (Ribot) has put forward: 'If we attempt,' writes he, 'to recall a good memory and to express this in physiological terms, we must figure to ourselves a great number of nervous elements, each modified in a particular manner, each taking part in one combination and probably capable of entering into several, each of these combinations containing within it the conditions of existence of the states of consciousness. Memory has then static and dynamic bases. Its strength is in relation to their number and stability.'[6]

" 'One asks,' continues Ribot, 'if each nerve cell can preserve several different modifications or if once modified it is forever polarized. The number of cerebral cells being about 600,000,000 according to the calculations of Meynert (and Sir Lionel Beale gives a much higher figure) the hypothesis of a single impression is not inconceivable.'[7] It may be remarked here that according to the hypothesis of mnemonic elements there is room in each brain cell for a whole series of specific deposits and not merely for one specific deposit....

"Provisionally it can be affirmed that the close dependence of memory upon the nutritive processes[8] indicates strongly that the preservation of memories is to be ascribed to accumulations of substances. Further, as was very well remarked by Hensen, the fact that many memories through-

[6] Ribot, *loc. cit.*, p. 32.

[7] Ribot, *loc. cit.*, p. 17.

[8] Ribot, *loc. cit.*, pp. 155-163.

out several years may remain completely quiescent and then can come again with great distinctness into consciousness, notwithstanding that all the parts of the organism have been renewed several times in the interval,[9] indicates (if one recollects that assimilation consists in the incessant reproduction of new masses, always of identically the same substance) that in order to preserve these memories it is sufficient if for one given substance there be substituted another identical one. The existence finally of several more or less clear, more or less intense memories, coupled with the fact that this greater clearness or intensity and all hypermnesia in general depend also upon phenomena of nutrition, indicate that the degree of vividness or intensity and the degree of hypermnesia in general may be a function of the mass of the substance concerned, on the accumulation of which the preservation of these memories is dependent.

"If it appears thus to be shown by facts, that the preservation of memories is due to accumulations of substance, a whole series of other facts seems to demonstrate that the reawakening of these memories consists in the restitution of the same currents as had formerly constituted the actual sensation or impression.

"We need not recall here all the innumerable examples which show that the motor or secretory or physiological effects in general of the mnemonic reawakening of a given sensation or impression are quite identical with those of the real sensation or impression: for example, the recollection of a certain dish produces the same salivation as is provoked by the dish itself; the memory of the beloved person can cause each time the same reddening of the countenance, the same brightening of the eyes, the same acceleration of the pulse as the direct view of that person; every

[9] Hensen, *Ueber das Gedächtnis.* Kiel, Universitäts-Buchhandlung, 1877, p. 13.

time that a mother thinks of her nursing child there comes a flow of milk into the breasts. These are some examples which show the substantial identity of the functional and mnemonic stimulus....

"If the preservation of each memory is due to deposits in number exactly equal to the specific elementary nervous currents which the sensation or complex impression had provoked in the nervous system, we are then in a position to comprehend also the phenomenon known under the name of abridgment: 'Every memory,' says Ribot, 'however limited it may be, undergoes an enormous abridgment. The farther that the present recedes into the past, the more do the conditions of consciousness diminish and disappear. Reviewed at several days distance there remains little or nothing of them; for the most part they have darkened into a nothingness from which they will never again emerge and have taken with them the time duration inherent in them. Consequently a diminution of the conditions of consciousness is a diminution in time.'[10]

"This disappearance of the elementary conditions of consciousness producing the abbreviation of the memory will be due, then, according to our view, to the disappearance of the secondary mnemonic elements, that is to say, those provided with a minimum quantity of the respective substance (and potential energy which is the consequence of it) from the series which constitutes the entire memory. Possibly this disappearance can be caused by the fact that the nutritive fluid has come gradually to be entirely absorbed by the principal mnemonic elements of the same series and by the new elements which later supervene as a consequence of later sensations also stored up in memory....

"In recalling a given memory the cells do not lose the 'impression,' as we call it, which they preserve of that mem-

[10] Ribot, *Les maladies de la mémoire*, pp. 44, 45.

ory; on the contrary, the more a memory is recalled, the more the respective 'impression' is reinforced. This signifies that the entrance into activity or function of mnemonic elements merely causes their mass and their potential energy to increase.... The active participation of the mnemonic centers in the biological phenomena of memory leaves them in the same state as before so that they are equally capable and even more capable than formerly of reproducing many more times the same phenomena.

"The reawakening of mnemonic centers at long intervals of years constitute very ordinary phenomena. Cases are frequent, for example, of adults who are able to repeat poems which they had learned in their earliest childhood, even after many years during which they have never had occasion to repeat them at any time. Coleridge speaks of a young girl who in the delirium of fever, repeated long fragments in the Hebrew tongue which she did not understand but which she had a very long time before heard read aloud by a priest in whose service she had been.[11] A Lutheran preacher of German origin living in America, who had in his congregation a considerable number of Germans and Swedes, related to Dr. Rush that nearly all, a little before dying, pray in their mother tongue. "I have," said he, "innumerable examples of it, and among them several in which I am sure they had not spoken German or Swedish for fifty or sixty years."[12] Rignano cites other similar instances, but in this review it is not expedient to multiply them. Such instances are familiar to every one. He continues:

"These examples show, then, how remarkable can be the persistence of conditions latent in memory. Let us note further, that these last cases present, in a very striking

[11] Maudsley, *The Physiology of Mind*, p. 25.

[12] Ribot, *Les maladies de la mémoire*, pp. 146-147.

form, what Ribot calls 'reminiscence from contiguity in space'.

"These reminiscences through contiguity in space are only a particular case of the general law of the association or succession of ideas. They indicate that the mnemonic center reacts only when the sight of the same place induces in the environment of that center almost the same state of nervous distribution as at the former time when it received the impression. That is exactly.... the result to which we were led by the hypothesis of specific elementary accumulators which have advanced."

Having seen thus how the faculty of memory finds an explanation in this simple hypothesis and how certain corollaries following logically upon its acceptance explain the various qualities of mnemonic phenomena, it remains to see in what way the fundamental process, which is suggested as the basis of memory, is inherent also in other vital processes. If it be true that currents of nervous nature, able to deposit these accumulator substances, are not confined to the nervous tissues proper, but pass constantly through the cytoplasm of all living cells whatever, to and from the nuclei, we have thus provided a mechanism whereby mnemonic faculties can be exhibited, by every part of living organisms. There is very good evidence that such currents do exist. Pfeffer demonstrated the presence in plants of nuclear excitations which passed through the cytoplasm and produced specific effects at the distance of several millimeters.[13] Commenting on Pfeffer's experiment, O. Hertwig states that "it is thereby proved that the stimulus necessary for membrane formation can be transmitted through the fine connecting filaments which pass through the dividing wall between two cells. There is nothing in the way of admitting similar means for the transmis-

[13] Pfeffer, "Ueber den Einfluss des Zellkerns auf die Bildung der Zellhaut," *Berichte über die Verhandlungen der königl. sächs. Gesellsch. d. Wissensch. zu Leipzig*, 1897, p. 507.

sion of other functional stimuli also."—"It is probable that the transmission of nuclear stimuli by protoplasmic filaments is much less rapid and less intense than nerve conduction, but perhaps for this very reason may be more continuous and by reason of its duration more efficacious."[14] All the phenomena of nervous nature exhibited by protozoa and low forms of animal life must depend upon similar nervous currents. While the higher animal organisms are still in an embryonic state, and before a nervous system is developed, such simple means of transmission of impulses by means of cytoplasm, protoplasmic filaments and intercellular bridges must be the only ones available. During the development of the nervous tissues proper, there must be co-operation of the two methods, as also in the adult organism in which there would thus be provided a general nervous circulation whereby the entire organism is connected up, both adjacent and remote parts into a single plexus.

The mechanism necessary for the general exercise of a mnemonic faculty being present throughout the organism, it is interesting to note that Hering finds the mnemonic faculty itself present, as shown in his book *Ueber das Gedächtnis als eine allgemeine Funktion der organisierten Materie,* pp. 16-17. Hering's assertion has recently been taken up again by Richard Semon, and more thoroughly and completely treated in his work, *Die Mneme als erhaltendes Prinzip im Wechsel des organischen Geschehens* (Leipsic, Engelmann, 1904). Ribot also states that "memory is essentially a biological fact, accidentally a psychological one."[15]

The possession by living matter in general of a mnemonic faculty should throw some light upon many of its activities and especially upon those which resemble mem-

[14] Oscar Hertwig, *Die Zelle und die Gewebe,* II, pp. 40-41.

[15] Ribot, *Les maladies de la mémoire,* p. 1.

ory. All those phenomena which show a restitution of a vital process, or a repetition of it many times, and always in the same way would find an explanation in this faculty. In this connection one thinks at once of the germ substance which in successive ontogeneses repeats a vital process, and tends to repeat it always in exactly the same way.

(Rignano, pp. 339-340): "The comparison between the phenomena of development and the phenomena of memory, especially after the discovery of the fundamental biogenetic law, that the ontogeny of each individual tends to repeat exactly the ontogenies of all its ancestors, has presented itself spontaneously to a large number of authors. 'The germ,' wrote Claude Bernard, 'seems to preserve the memory of the organism from which it proceeds.'[16] Haeckel attributes development to the mnemonic quality of his plastidules.....Orr endeavored to explain recapitulation during ontogeny by the mnemonic law of habit. Cope held that ontogeny is called forth by the unconscious memory of phylogeny. Naegeli and, in some places, Hertwig, himself, attributes to the idioplasm the faculty of remembering, so to speak, the successive phylogenetic stages through which it had gradually passed.

"But it was above all Hering who maintained most boldly the fundamental identity of the ontogenetic and mnemonic phenomena: 'What is it that causes this reappearance in the daughter organism which is developing, of characters of the parent organism if it be not a reproduction on the part of organized matter, of processes in which it has already taken part at another time, if only as a germ in the ovary; and which now at an opportune moment it recalls exactly while reacting to the same or similar stimuli in a manner similar to that which the preceding organism has already followed, of which it was formerly a part and

[16] Claude Bernard, *Leçons sur les phenomenes de la vie communs aux animaux et aux vegetaux*, p. 66.

of the vicissitudes of which it had then shared? If the parent organism by long custom or repeated action has changed somewhat in nature in such a way that the germinal cellule within it has also been affected, however feebly it may be, and if this latter commences a new existence growing and developing into a new being of which the different parts are not other than itself and flesh of its flesh, and if in thus developing it reproduce that which it had already experienced at another time as part of a great whole, this is also precisely as astonishing as when memories of his early childhood are recalled suddenly to the old man, but it is not more astonishing. And whether it may be still just the same organized substance which reproduces a process already once experienced, or whether it may be only a descendant, a portion of its substance which in the interval has grown and become large, this is manifestly a difference of degree only and not of essence.'[17] The observation of the similarity of the two processes, although extremely interesting, so long as neither phenomenon was understood, did not help science much in its search for the fundamental causes. Rignano remarks (pp. 341-342) that "this extension of the mnemonic faculty over every vital phenomenon without exception, [including development] although it contains much truth, could not by itself constitute any explanation of either one phenomenon or the other, but on the other hand helps to plunge both into deeper darkness; for while by this comparison the obscure fundamental peculiarities common to both become in no wise clearer, the most striking characteristics of each of the two phenomena which are different in the two, and which are those that up to the present have served to give us the most exact ideas possible of their respective phenomena are left out of consideration.

[17] Ewald Hering, *Ueber das Gedächtnis als eine allgemeine Function der organisierten Materie*, pp. 16-17.

"The phenomenon of memory can serve neither as an explanation of the phenomenon of development nor of the vital phenomenon in general, because it constitutes itself a phenomenon more special and more complex than those it was summoned to explain. There was still, however, a possibility that the resemblance which appeared to exist between some essential characters of these three phenomena might be explained by a fourth more general and more simple phenomenon, which would be at the same time the basis of all three categories of phenomena; the ontogenetic, mnemonic properly so called (psycho-mnemonic), and the vital."

This hypothesis of specific nervous accumulators constituting germinal, mnemonic, and vital elements affords an intelligible explanation of that basic property which would explain and unify all three.

EXPLANATION OF ONTOGENY.

In his biogenetic law Haeckel formulated the marvelous phenomenon of recapitulation of phylogeny during ontogeny. During the course of ontogeny the developing organism tends to repeat the development of its ancestors, one after another, passing from stage to stage in the order in which those stages appeared in evolution. Thus even though modifications may supervene, it can be said that at each stage it represents the form of an ancestor which attained at that stage its full development. From the beginning of development the same stages follow one another in the same order in all animals in so far as they have a common line of descent. Some influences come into activity within the embryo serially, causing it to pass from each stage to that following next in the oft repeated series. This principle of repetition in embryological development, although so familiar, is yet inexplicable. So far there has

been no satisfactory explanation of what the impelling forces are, nor of why developmental stages should succeed one another always in the same order recapitulating phylogeny.

But the phenomena become intelligible if with Rignano we consider the germ substance as constituted by specific, mnemonic, germinal, elements quite like the specific mnemonic elements of the brain substance. Just as stimuli acting upon human bodies, in addition to bringing about physiological changes and sensations cause also the deposit in the brain of corresponding specific accumulators (as we have already noted in our consideration of memory), so also the stimuli, whatever they may have been, which acted upon the germs of the ancestors of organisms now living, in addition to bringing about developmental changes would also cause the deposit in the germ of corresponding specific accumulators. Just as the specific mnemonic accumulators in the brain cells are able, when conditions permit their activation, to cause former stimuli (nerve currents) to be reproduced capable of causing a repetition of the same sensations and physiological changes, so also the specific mnemonic accumulators in the germ substance would be able when conditions permitted their activation to cause former stimuli to be reproduced capable of causing a repetition of the same developmental changes. And this repetition will be effected during the development of organisms of later generations.

There is thus suggested a working hypothesis by which we can understand what the impelling forces of development may be and whence they come. It remains to be explained why developmental stages should succeed one another always in the same order recapitulating phylogeny.

In memory there operates the law of association of ideas and we have seen this to be dependent upon properties which specific, mnemonic accumulators must pos-

sess in accordance with the general physical laws to which they are subject.

If we admit the general rule then developed for specific accumulators, by which (pp. 315-316) "the quantity of work requisite for effecting a given change in the dynamic equilibrium of the whole circulatory system, is proportionally greater, the more considerable in quantity and quality the change is, it becomes at once conceivable why each specific potential element of the germinal centers can become activated only when the embryo has reached the ontogenetic stage, corresponding to the particular phylogenetic stage, at which this element had been acquired by the germinal substance. For then first will the change which the dynamic system of the embryo undergoes, as a result of the activation of this specific potential element, be the least possible, and therefore generally also the only one whose resistance can be surmounted by the very weak nervomotive force of this specific potential element." Therefore these accumulators must become activated one after another, always in the same order, and always in the order in which the corresponding stimuli had become operative in phylogeny. We thus have provided a mechanism which, acting with all the certainty of a physical process, must tend to cause developing organisms, in so far as they have common ancestors, to pass in the same order through the same series of changes, namely those through which their common ancestors passed in evolution. And this arrangement is the same as that which causes recollections of successive events to come up, according to the mnemonic law of association of ideas, in the same order as that in which the events themselves had originally occurred.

(P. 354) "In mnemonic phenomena proper [psychic], they are the infinitely diverse and constantly changing conditions of the external environment, and the corresponding sensations following in the individual which call forth like

a phantasy such and such an association or succession of ideas. But in the development of the embryo which is removed from the action of every external perturbating influence and above all, which is provoked by the activation of different specific germinal elements from one and the same complex mnemonic center constituted by the germinal substance, the succession of mnemonic states of this latter called into activity one after the other, and of the corresponding stages of ontogeny must inevitably proceed in uninterrupted series, always the same for all individual ontogenies of the same species. For to reawaken each mnemonic element of this germinal substance there must again concur exactly the corresponding conditions of nervous distribution of the embryo which had been provoked by the re-awakening of the mnemonic element immediately preceding.

"It is then in development even more than in mnemonic phenomena properly so called that there operates the law of rigorous succession, in which, as Ribot says, each member of a series produces the following."[18]

Just as there is abridgment of every memory, so there is also abridgment in the recapitulation of ontogeny by phylogeny. (P. 351) "In fact of the older mnemonic elements constituting the germinal substance, the strongest, that is those which are represented by the largest quantity of substance, alone persist. The less strong older mnemonic elements, the total quantity of nourishment for all mnemonic elements remaining the same, or varying only within definite limits, will have all their portion of nourishment taken away by the strong older mnemonic elements and by the newer mnemonic elements whose number will continually increase with each phylogenetic advancement. Not being able consequently to regain their substance completely in each ontogenesis, they will gradually disappear."

[18] Ribot, *Les maladies de la mémoire,* p. 8.

Thus ontogeny becomes not a full but only an abridged recapitulation of phylogeny.

Further, just as in memory the time factor is eliminated, so in ontogeny, the specific germinal accumulators become activated as soon as the conditions permit and the organism in its development runs through in a few days a series of changes, which may have required thousands of years in phylogeny. Just as in memory specific mnemonic elements may become activated only after intervals almost life-long, so the specific germinal elements will become activated only in the ontogeneses of successive generations. Just as in memory, reminiscence does not exhaust the mnemonic elements, but strengthens them, so in ontogenesis the repeated development of characters fixes them in the germinal substance, and palingenetic characters are more firmly stamped upon the race than cenogenetic.

In this hypothesis of specific germinal and mnemonic elements, accumulators each of a corresponding specific nervous influence, Rignano has suggested a common basis for the phenomena of memory and ontogeny, which explains both these processes and unifies them. In affording such an intelligible explanation, the hypothesis stands alone, for while these phenomena have been among those most studied, they remain among the most marvelous in biology, or perhaps in the whole field of human knowledge. No satisfactory explanation has even been suggested heretofore, and such a conception of them as Rignano's, explaining them in terms of physico-chemical laws already known, will be welcomed and carefully considered by all biologists whose work has led them to feel the need of such explanations and to the conviction that they must rest upon a physico-chemical basis.

The many observations which have been made, of the resemblance between mnemonic reproductions of the likeness of former things, and the reproduction in an embryo

of the likeness of its ancestors, which heretofore have been vague and misty, become in the light of this conception vastly more interesting, and become also vastly more significant and valuable to science in its search into their essential character and into the nature of the vital process itself.

(P. 355) "In summing up all that we have said thus far we can thus affirm that if the mnemonic phenomena, properly so called, can not serve to explain ontogenetic phenomena nor the latter to explain the former, the resemblance which has nevertheless been noted by so great a number of authors can be explained by a third phenomenon more general and more simple than either. And this phenomenon consists in the faculty possessed by all living substance of accumulating and repeating individually different particular specificities of generic nervous energy, and this constitutes the essence of all vital phenomena whatever."

The question of the transmission of acquired characters is treated in the book at considerable length, the author regarding it as of the greatest interest and importance. He states that in his earlier studies he was inclined to reject the Lamarckian theory largely because there was no conceivable mechanism available for an explanation of transmissibility.

But in this hypothesis he sees a way by which functional stimuli which bring about somatic modifications may bring about corresponding modifications of the germinal substance also, understanding by the term functional stimuli of course the stimuli set into operation within the organism, and not the external action of the environmental stimuli which provoke them.

For if the stimuli which during phylogeny cause the acquirement by a species of new characters are produced in the individual organisms as a result of the action of external environmental stimuli, then this hypothesis affords

an explantion of how they may be transmitted to the germinal substance, for such stimuli passing throughout the entire organism, which as we have seen is one vast plexus, not only cause in some parts the development of new characters, but also cause the deposit of corresponding specific accumulators in many cells, the germ cells among others. Those deposited in somatic cells will disappear with the death of the individual, but those in the germ cell, will be in a position to effect the continuation of the new character in the species, if they have been deposited in considerable mass, as a result of the action for a long time of a persistent new environmental stimulus. For such accumulators, becoming activated when the development of the organism which they produce has reached the stage, corresponding to that at which the new character was acquired in phylogeny, will cause the same morphogenic stimuli to be discharged, which acting upon the developing organism will at once cause it also to develop the new character.

Other phenomena, such as atavism, reversion in hybrids, sexual dimorphism and polymorphism are taken up, but it must suffice here merely to refer to the book for a consideration of them. Manifestations of these properties by living organisms is shown to be quite in conformity with the hypothesis he has advanced, and to find in it some explanation. The author continues (p. 356):

"It remains for us to demonstrate that this property as we have affirmed before, can aid us in great part to explain the essential characteristics of the vital phenomenon itself in all its generality—that is assimilation."

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[to be continued.]

HAS THE PSYCHOLOGICAL LABORATORY PROVED HELPFUL?[1]

THIS is a question stated in such a way that many people will find in its very statement a negative reply. But my intention here and now is to put a question without giving the answer, to state a problem without solving it. It is something indeed to state the question. Were I to give an answer it would demand more time than I would be justified in consuming. I will not give the external history of the laboratories; this would avail us less than one might think. My task is more modest or more pretentious as you prefer; I confine myself to mental impressions, which, nevertheless, can bring us nearer to the truth than history. How many times an institution conceived and established in a certain spirit ends by working in a different spirit to serve still another spirit.

A psychological laboratory!—I do not know what there is in the shop, but it must be admitted that it could not have a droller sign. You may say I am jesting but there is no other way to interpret the expression than somewhat after this fashion: Here ideas are manufactured, volition is distilled, sentiment is created. So it seems that even the intent and the conception of a psychological laboratory must be the result of a misapprehension and at the service of this misapprehension; it seems that philosophy has noth-

[1] Address delivered on September 4, 1908, before the Third International Congress of Philosophy at Heidelberg; translated from the French manuscript of Professor Billia by Lydia G. Robinson.

ing to do but to refrain from taking interest in it, or perhaps to enter just once in order to administer charitable advice and to give the savants in charge of the laboratories a little instruction in modesty and prudence by making them see how vain and deceptive is the pretense at studying and knowing the facts of consciousness outside of consciousness, and how greatly one is deceived by the most pitiful illusion when he imagines that what he measures, what he pulls and pushes, what he weighs, and what he analyzes by the aid of material things is really consciousness, thought, sensation.

But in this task of removing a misconception, we soon meet with a difficulty which proves a hindrance; or, rather, restrains us for the time being and makes us consider the matter once more. We are not overawed by the insolence of those who appear to work for the purpose of reducing the facts of consciousness to the measurement of material facts; on the contrary what has detained us is the good faith, the serious spirit and the useful contributions of others who are true experimenters. With what right are we to teach modesty to modest men, logic and the limits of experimental research to those who pursue the study of its logic and are well aware of its limits? When we step into the laboratories of the Claparedes, of the Flournoys, of the De Sarlos, of the Kiesows (I can not undertake to make the list complete) we find ourselves face to face with men who tell us without any reservation that they are in search of facts only, that they do not work in behalf of a system or a party but for the single purpose of contributing to the knowledge of mental facts. These are the men who do not wait for our reservations to assure us that they have never pretended to tell us what sensation is or what thought is, nor whence they originate, but only to determine some conditions of the nervous system, or the organism, and even of the environment in which the

facts of consciousness are produced in such and such a way, and even when they are produced or when not. This has impressed us; it has disarmed us; it has instructed us.

Further, truth has nothing to fear from truths. We have readily understood that this serious study of the external and physiological conditions of the facts of the soul would have brought us at the same time to a better recognition of these facts and to the clearer and clearer distinction between these facts and their permanent conscious and individual principle on one side, and on the other of the somatic conditions in which they manifest themselves.

Finally, there is no other point in question than to be able some day to give an exact solution to this correspondence of each different instant which obtains in the consciousness of every person. Formerly I tried to reduce this correspondence mainly to a limitation of the power of reflection,[2] which becomes manifest in the consciousness even of philosophers at certain hours of the day when in a state of fatigue, exhaustion or intoxication, and which indeed may be the condition of the whole life of certain unfortunates whom we call fools, simple minded, and idiots. If this solution could be reached how many problems would be solved! There would then be some hope of carrying out the old well-known and very audacious assertion of Descartes that medicine would one day be able to govern the mind and the character; that is to say, to deliver humanity from evil and disorder. Education would no longer have to struggle continually against difficulties and recurring deceptions, because it would know in advance what might be expected of each individual under definite conditions.

This is a matter of which we have had some idea for a long time. We might even find precursors of psycho-phys-

[2] *Lezioni di Filosofia della morale,* VII. Rome, Torino, 1897. Ernest Naville e il libero arbitrio. Rome, Torino, 1900.

ics in the greatest metaphysicians of earlier days. An investigation which I myself have made with the intention of proving that the great metaphysicians were also great masters of observation, has led me to discover an advanced psycho-physics not only in Rosmini who is too modern to prove my point, but in Malebranche and even in Plato.[3] That which was then still lacking and could not be expected until the science of to-day and of the future, was measurement and exact determination. The nearer we approach to this measurement and exact determination, the more we see that it by no means supplants the idea of the mind and of its action upon itself, not even pretending to explain its production, its origin and nature; but only to establish limits and conditions, in such a way that even if the laboratory was established for materialistic purposes its triumphs and its most serious results have been in the service of spiritualism. As my friend M. Adrien Naville has said: "It will always be understood more clearly in proportion as the physiology of the brain progresses. Anthropological monism can only live in the twilight. When physiologists shall have succeeded in expressing in definite mechanical formulas the movements of the cerebral cells which are analogous to facts of consciousness, no one can insist that these facts of consciousness are the same thing as a movement."[4]

The evident conclusion from all these observations and all these considerations will therefore be that psychological laboratories are the more useful and conspicuous an aid to the study of the mind according as the expectations of the scholars who looked forward to them are more modest, and the results more precise, definite, determined, positive.

But there is a train of ideas which carries us along in

[3] *Delle dottrine psicofisiche di Platone,* Modena, 1898; Esti. d. Atti d. Accademia. *Delle dottrine psicofisiche di Nicolò Malebranche,* Berlin, 1900. *L'esiglio di S. Agostino,* Turin, 1898.

[4] *Revue Scientifique,* Mar. 5, 1887, p. 316.

spite of ourselves. We have seen that the psychological laboratory has carried the materialist and the positivist in the direction of spiritualism. But whither is the spiritualist led who, disarmed by the modest and earnest bearing of his ancient adversary, enters into the laboratory, shuts himself up, and abandons himself to the confident expectation of finding there a more exact confirmation of all the truths of his consciousness and one more suitable for persuading others?

I. In proportion as he acquires a more precise, more exact, more definite knowledge of physiological, and even of physical and chemical conditions, in which and under which such a fact of sensation, of thought, and of will is produced, he runs the risk of losing the clear vision of what this fact truly is; very much as those literary critics who are better informed about the exact day and hour of Dante's birth and the exact spot in Florence where his house stood and about the gate of the town from which he departed to take his flight in exile, are not always the ones who best penetrate into the spirit of the loftiest of poets. By seeing that a phenomenon occurs under such circumstances, one is led to believe that it has not occurred and does not now occur except under such circumstances; and with this we have now come back to the prodigious misapprehension of a fact of consciousness studied outside of consciousness. In other words, in spite of the best intentions to the contrary, psychology itself is destroyed by the psychological laboratory.

II. Again, the experiments in the laboratory give us such a habit of considering and measuring the limitations of our power of feeling, of understanding, and of willing, that they lead us to forget another side of our psychical life which is no less a true side, namely liberty, and the power of passing beyond those very limits, and of extending our faculty of feeling, understanding and of willing

still farther beyond. Certainly to find an exact determination of the physiological and physical limits of our intellectual and volitional operations appears to be a great triumph, but in the first place who said that this determination would be the same for all? or that it always results in the simple combination, that *a* being given as the sum-total of physiological conditions we will have *b* for the sum-total of psychical conditions and that each change which takes place in *a* leads necessarily to the same change in *b*? This indeed would be a most comfortable and alluring theory, but here is where consciousness will have to do with facts which throw a great suspicion of doubt upon this formulation. Psycho-physical correspondence[5] is not at all constant. I am not a pragmatist not a Bergsonian. I do not say that it defies all rule, all possible determination, I simply say, and I insist upon it, that it is not confined within the limits of the determination furnished by the laboratories or through the laboratory method. For instance, it is easy to admit that during the day in the ordinary life of a healthy person with a good constitution, and still more during the day and in the ordinary life of a person somewhat delicate and ailing, there is a physiological limit beyond which he loses the power of reflecting which should operate in two processes becoming more and more painful and finally unbearable; viz., the effort to pay attention to a long and complicated series of ideas, of symbols, and of images, or of circumstances which compel a decision to be made; and the effort to fix one's mind for a long time upon the motives which persuade us to endure to the end something requiring great patience. For instance, you all agree in admitting that you could not endure the tiresomeness of my discourse for three hours, and, for my part, I could not endure certain noises for a few consecutive minutes

[5] Those who do me the honor to grasp my thought will have to content themselves with the word correspondence. Identity would indicate too much and parallelism too little.

without being greatly disturbed. They say, or at least we are constantly besought to have the decency to believe, that the learned physiologists have determined by exact measurement the intoxication of nerve centers, the exhaustion of nervous and muscular force, the breaking down of tissues, especially in the brain, which corresponds to the mental relaxation as its only cause.

But right at this point, if many facts seem to justify these conclusions, other facts, less numerous to be sure but well established and authenticated, give the lie to the pretensions of those who would measure exhaustion if they try to give the results of their experiments as an absolute and universal law. If a tyrant were to make my lecture last four hours the rest of you though reduced to extreme exhaustion would still be able to give your attention to a soothing melody which some solacing spirit might cause to resound and even to a homelier fanfare from the street. However, it is a fact of almost elementary physiology that because of the multiplicity of vibrations the nervous fatigue of a man who listens to the best of concerts is far greater and far more exhausting than that of him who listens to the dullest of lectures.

Soldiers who faint from thirst and fatigue and are no longer conscious of their surroundings will throw themselves once more into the assault if they are made to believe that victory is sure or that their safety rests on the condition of one supreme effort. Those who, like myself for instance, have a very delicate nervous system often experience moments of such exhaustion that they require absolute and immediate relaxation and repose. There must not be the slightest delay for this recuperation, no noise, nor any effort of attention. Now if under these conditions we come home and find that some member of the family has suddenly been taken ill, that a child is in danger, that the daily paper has given a false report prejudicial to our

scientific or political reputation or to our party, and that its refutation cannot be postponed later than the edition of the following morning, we are at once ourselves again, we summon our forces, our attention, and we postpone our fatigue, dismissing all thought of supper and bedtime.

It is true that we have reserve force, but this only succeeds in deferring the difficulty. It is according to our discretion that we draw upon these reserves, therefore the limit is not absolute,—or if there is an absolute limit it is not the physiological limit; or if it is always a physiological limit it is not the one which the laboratories determine or are able to determine.

Please consider once more that this extension and widening of limits which takes place suddenly in the presence of a motive may in certain individuals indeed become a constant exercise, the limits to be extended day by day, and powers of feeling, thinking, and willing to be indefinitely increased. The laboratories teach us these limits. Consciousness here confronts us with a great mystery; where are the limits? As soon as the limit of one instant can be removed to the instant after and so on, is there still another limit in this power of extending the limit? I state the question but I do not expect it to be answered. I have only to say that this is the great question of psychology; I have only to say that the laboratory which forgets it, in so doing destroys psychology.

To be sure, to give us an idea of limits which is perhaps instructive and wholesome, may render us more discerning towards ourselves and towards others, may give us the wisdom to avoid claiming the impossible. But the habit of always taking physiological limits into consideration may also stifle the consciousness of our inner powers, the consciousness of the power of the mind acting with an ideal in view. More discerning alas! But it has also given us a cowardly habit of considering certain disorders such

as debauchery, drunkenness, slavery, war, and capital punishment, as if they were determined by external and organic conditions, and to forget the agency of liberty and its power in degenerating as well as in upbuilding,—agency and power which are no less positive facts than all the physiological determinations, and moreover are themselves the determining factors.

III. Finally, the psychological laboratory leads us to treat mental facts as external objects of experimental research and curiosity. But mental facts are not that. The mind which we observe is nothing else than we ourselves who live and ought to exist in a certain manner. The question is not to see how some one or some thing operates. The important thing is that we ourselves should always be and do well,—always better. There are experiments which should not be performed because they injure us, deteriorate us, remove us farther from perfection. Only those experiments should be performed which in themselves are a step in our development. Not all curiosity should be satisfied because its satisfaction is at our expense, because it is on ourselves that the experiment is made.

A bigoted man of science may challenge me with the scandalized question: Would you found education upon ignorance? Not at all; it would be offensive to say and absurd to think. But it is well to have the courage to state clearly that some ignorance is an indispensable element of education. Why? Precisely because at bottom human education is in no way possible unless it is founded on science, which is at the same time both the means and the end of education. Now some ignorance is the indispensable condition of all knowledge. I may know all the gossip of the town, yet I will be very ignorant not *in spite* of this, but *on account* of it. You are scholars not only because of the attention you have given, but also because of that

denied. Whoever wishes to acquire a practical acquaintance with the sights and especially the sensations, of cruelty and debauchery, must condemn himself to ignorance of decent and charitable feelings, or at least of the noblest sentiments of mankind; and *vice versa,* he who would acquire a true, faithful and complete knowledge of these must needs renounce forever not only the practice of the wrong things but knowledge of them as well. Still considering the lack of a system and the brevity of life and other hindrances to vast knowledge, it is by no means impossible to form a truly cultivated mind without sacrificing a great deal of detailed and encumbering erudition and without yielding either to the many particulars of that form of presumptuous ignorance which is called *specialism,* or to a large part of the medley of the other form which may be called encyclopedic. We owe the greatest portion of our knowledge to books that we have read; but much also to our good fortune in having escaped reading many others.

My position with regard to these observations is that of a φιλομαθής but not a partisan; consequently I like to consider the matter in all its aspects. I have often thought of one thing which seems to contradict my conclusions. A large part of the studies of physicians accustom the young men to a familiarity with sights which on account of their nature and circumstances are by no means apt to cultivate respect and delicacy of feeling. Nevertheless being acquainted with many physicians I have no right nor inclination to participate in the unfavorable opinion of them professed by Jean Jacques Rousseau—although otherwise he was so compassionate in his writings; for I have observed it to be an undeniable fact in the case of many physicians and surgeons that they have preserved and cultivated as delicate, tender and sympathetic a heart as the gentlest and mildest maiden. I have observed this in phy-

sicians and surgeons who were noted for having held the greatest number of autopsies. I account for it by the mastery over impressions and feelings held by a mind dominated by the idea of duty; viz., a strong well-formed and well-balanced character is able to overcome his repugnance to the hideous and shocking, precisely for the purpose of respect and goodness, braving the repugnance from a higher motive when there is need, sacrificing self when demanded by justice and decency. The same principle impels the good physician to insert the knife into the flesh and inspires him to endure the most exacting fatigue, endeavoring to prevent any suffering to the patient rather than avoiding an indecent or indelicate sight.

But the conclusion I draw is by no means negative or to throw doubt on the preceding considerations, or to limit inquiry. On the contrary, this is my conclusion: Since medicine alone is not able to make or mar the man, but its task is most critical, and the physician's aim most delicate and sublime (viz: not the recovery of an organ, but the health of the man), medicine ought finally to be understood not at all as a mercenary trade, but as a priestly office, a mission of devotion the function of which is charity; and we should require of the physician a proportionately moral superiority. Whenever found it is reasonable to attribute this superiority to individual character; and to doubt whether the discipline and curriculum of our universities makes any provision for it.

Psychology is not the same kind of a science as pure chemistry or pure mathematics whose object is something else than the subject which studies and observes. Psychology is the science of ourselves and our actions, and our actions are in process while being observed. It is the science of the self and nothing can be observed with regard to the self unless it be the self or a part of the self.

I do not think in the least that I am the first to make

a discovery in pointing out this singular condition of psychology which distinguishes it from all other sciences. My purpose is only to call the attention of the studious to a fact which should not be forgotten and to deduce from it a conclusion which may perhaps be new, and in any case stands out in bold relief. No science changes its object: the mathematician makes no change in the nature and relation of numbers; physicists and chemists do not create the phenomena which they report. If accidentally the environment disturbs the experiment and unexpected compositions are formed, the mistake must be at once corrected and the disturbing factor removed. Or perhaps a new property is discovered or it becomes clear that it is impossible to make the experiment; in any case the novelty of the phenomenon is not attributed to the experimenter simply because he observes it and makes a note of it.

In psychology quite the contrary is true. The observation that is made of the facts of the soul does not leave the facts as they were before. If I perceive that I am ignorant, I am no longer as ignorant as I was. If I perceive that I am wicked, I would naturally begin to overcome a part of my wickedness. He who perceives that he is in love is no longer in love in the same manner or the same degree as he was. Perhaps he becomes more so, perhaps less, but never the same. He who nurses his passion each day and each hour and examines it with a critical eye, either causes it to grow to the loftiests heights or else effaces it by his analysis. Never will it remain the same; never would he be able to say to himself, "Up to this point it was spontaneous; afterwards voluntary, cultivated." The spontaneous to which consciousness bears witness ceases to be spontaneous.

It is for some purpose that we are woven in the fabric of self, quite simple though it seems, and even with respect to matters which we deem of minor importance. If I per-

ceive that I am sick, perhaps in my stomach, I become at once a little more or a little less sick than before and the same thing is true if I perceive, if I state, if I declare that I am recovered, if I wish to recover. Nothing is more real than the diseases which are called imaginary. If this is true beyond doubt in the action of the first acts of consciousness, how much more true would it be in a series of acts of consciousness purposely continued, of attention, and of reflection, such as form the subject of psychology? Rosmini who pointed out this fact long before and much more clearly than Wundt, recognizes here one of the difficulties of introspective observations, and a less fortunate condition than that of physical observation.[6] But one might as well conclude that psychology, although absolutely lacking in scientific precision as it is, possesses after all a greater value than all science. Whether harmful or beneficent, psychological study would never be useless or indifferent. It is quite impossible that observation, study, and psychological science, or the concern for psychology, would not modify profoundly and to a great extent the soul, the mind, the affections, conduct, and finally society itself even if psychologists would not assume, even if they would refuse, the character of apostles. This then is another source of the considerations which lead us to conclude that psychology is not a curiosity such as laboratories make it or may make it. Nor is it only, as puny pedagogues teach, preliminary to the science of education; it is education itself.

In the self one should not admit the good and the bad, the higher and lower, the refined and the common, as two varieties equally interesting and worthy of study, but only the good, the higher and the fine should be admitted and cultivated. The evil, the lower, and the coarse ought not to exist, and if they do they should be exterminated. Psy-

[6] *Logica*, p. 952.

chology is not a curiosity; there is but one aim of science, perfection. The laboratory forgets this fact too often. I say it forgets, and do not refer to some criminal experiments which are not mere forgetting or due to ardor and which I would recommend not to science but to the regular police department. But even in simple negligence, even in that eagerness which has made of psychology a research into conditions and effects without consideration of endeavor and liberty, one may say that in spite of all its good intentions, the psychological laboratory destroys psychology and also ethics.

Should then the laboratory be suppressed and its doors closed? Not at all. I have said that I would state questions and not that I would draw conclusions. I would only make a proposition. It is not necessary to suppress anything or to close anything. It is necessary to uplift. Let us raise the standard of the laboratory. First of all it must become truthful. It can do so by dispensing with a name which is a contradiction. Psychology does not operate in a laboratory. The true laboratory of psychology is nothing but consciousness.

Here I shall insert a parenthesis, even if it destroys to some extent the harmony of my discussion, in order to answer in advance an important objection which may be made to my position. Apparently I have exposed myself to being addressed thus: In speaking of psychological laboratories you have limited your attention to the psychophysiological laboratories which measure the effects and the organic conditions of mental acts; you have ignored or neglected those other laboratories where measurements are not taken but records are made of observed facts, of statistics; as for instance how many of the one hundred individuals who daily enter the same door would be able to answer accurately questions about the number, size or arrangement of the windows of the building? Out of one

hundred pupils in a school how many will we find who are able to pay strict attention for a quarter of an hour, etc., etc.?

I have considered the point well. Measurement and the pretense of psycho-physical equivalence served the purpose of my argument more simply and clearly, but my aim was directed against every attempt to study the facts of consciousness outside of consciousness. There are three points of criticism which even the psychological laboratories that renounce physical measurements in favor of statistics, do not entirely escape:

1. Psycho-statistical researches can have no accuracy unless they take into account the organic conditions of race, health, development, and nutrition. That is to say, out of 100 there are perhaps thirty who pay attention and seventy of whom not one would have any opinion except with regard to how long it was since he had a meal, whether he slept well the night before, whether he is anaemic, who are his parents, where he comes from, how his stomach, heart and lungs perform their functions. Hence psycho-statistical researches have no value unless they are founded on psycho-physical investigation and measurements, and if they depend on these they are subject to the same criticism as the latter.

2. They also fall under the criticism of making a curiosity of psychology while forgetting that its purpose is education.

3. Statistical psychology having for its aim the establishment of a certain determinism also leads us to exaggerate its limits, but perhaps a little less than physiological psychology. Perhaps it can also give us some idea of those who exceed the ordinary limits and stimulate us by such examples to exceed them ourselves. But so much the better. I do not wish to be destructive.

However, the fundamental misapprehension remains,

—the illusion of studying outside of consciousness a fact which takes place only within consciousness and which outside of consciousness is not even conceivable.

Therefore let us retain and preserve experimental investigations on the nervous system, and if we wish to keep the name of psychological researches let us expand them. Instead of confining ourselves to studying limits, conditions leading to psychical disorders, or even to provoke them which would be criminal,—let us study in consciousness the power of the mind, endeavoring to see to what point in ourselves we can cultivate self-denial, the power of attention, growth, development of faculties, and of the hidden varieties of feeling, understanding and willing, the power of abstraction, devotion, affection. Let us care for the insane and the sick, but let us cultivate especially heroes, saints, and superior beings.

LORENZO MICHELANGELO BILLIA.

TURIN, ITALY.

A BIOCHEMICAL CONCEPTION OF THE PHENOMENA OF MEMORY AND SENSATION.

FROM the earliest historical epochs to the present day, philosophers have expended a considerable proportion of their energies in framing replies to the question whether mental phenomena are, or are not, capable of resolution into law; of material, that is, physical or chemical, interpretation; of exact mathematical analysis. Not only philosophers, but also men of science, and others addicted to metaphysical speculation, have added their quota to a discussion the age and inconclusiveness of which has sufficiently demonstrated its sterility. As is customary in metaphysical discussion, the answers which have been propounded to this question are as numerous as the philosophers themselves. From the dualism which regards the mind as a species of "gaseous vertebrate" dwelling within but not, or only in a minor degree, subject to the physical and chemical laws which govern our material body, to the monism of Giordano Bruno which regards material objects as the "shadows of ideas," the mind the reality, matter the phantasm, and to the monism of Comte, which is the inverse of that of Giordano Bruno, every transition of opinion can be found, every shade of formulation, every compromise, and every absurdity which ingenious imagination, untramelled by fact, can delude itself into believing.

One by one the problems with which the metaphysicians have busied themselves in the past have been wrested from

their hands, and received into that domain over which fact and not hypothesis rules; the domain of science. And it was inevitable that this ancient question must ultimately also acknowledge the suzerainty of science, for it was one which experiment, and experiment alone, could decide.

Those philosophers who postulated the superiority of mental phenomena over law, their freedom from the invariability of sequence and consequence which characterizes material phenomena, and, consequently, their immunity from exact formulation, measurement, and material interpretation, placed themselves in a position of considerable insecurity, for a single experimental proof of invariability of sequence and consequence in mental phenomena would set at nought their hypothesis and close the time-worn discussion for ever; the outworks once stormed, the citadel of their belief was doomed. This is why the exact and laborious investigations of Weber and Ebbinghaus, and of scores who have succeeded them, have definitely answered the question of the independence or interdependence of mind and matter and have placed science, once for all, in possession of the realm of mental phenomena—for these investigators have demonstrated that sensation and memory are capable of measurement and that they obey definite laws susceptible of mathematical formulation, and, therefore, of material interpretation.

But belief dies hard, and conviction of the futility of any discussion is a product of slow and painful growth, and thus it happens that among a large group of writers and thinkers (comparatively few of them biologists, however), controversy still rages over the question whether mental phenomena will ever yield to the all-conquering methods of science, and the belief still holds sway in that last outpost of primitive anthropomorphism, the "gaseous vertebrate," immanent within, but independent of the material organism.

It is possible that for a definite closure of this discussion, for the final annihilation of the naive anthropomorphism which holds humanity in thrall, we must look forward to ages coeval with the realization of the celebrated "world formula" of Laplace.

In order to be susceptible of scientific measurement, of comparison with standards, any quantity, whether it be a quantity of length, mass, heat or sensation, must be capable of being perceived directly or indirectly by the senses, and no mean portion of scientific advance consists in the opening up of new fields of research, and consequent knowledge, through the invention of new methods of bringing objects before the senses, and thus artificially enhancing their acuity.

It is not sufficient, however, that the object to be measured should be capable of being brought before the senses of a single individual—it must be capable of being brought before the senses of universal humanity; the phenomena observed, and the quantities measured, must be capable of indefinite duplication and repetition; for the evidence of a single individual, however careful his investigation, however exact his methods, and however sincere he may be, is valueless from a scientific standpoint unless the data constituting his evidence are obtainable by all. It is this possibility of indefinite reduplication which confers upon the data of science their certitude; for although "a plurality of suffrages is no guarantee of truth," yet a plurality of *evidences* is a guarantee of *probability*—and the whole edifice of natural science is nothing other than a vast outgrowth from the science of probability; in itself a group of inductions from universal experience.

Now it is true that the phenomena of our mental life are, to each one of us, individually perceptible, but they certainly are not, as a rule, perceptible, at present, to universal humanity. The mental processes occurring in A

are certainly very real and perceptible to him but he cannot, as a rule, measure them by any standards except his own, since those of B are inaccessible to him. Imagine a piece of iron which is conscious only of its internal condition and unable to compare it with external conditions, and suppose it were to try and measure its own length. It might do so by fixing upon an arbitrary portion of itself as the unit of length, and then perceiving that its total length was a certain multiple of this unit. Suppose, however, that at some subsequent period the temperature were to increase, and the piece of iron were to endeavor to repeat the measurement; its length would have increased, because iron expands with heat. But since each particle of the iron undergoes expansion in the same proportion, the piece of iron would imagine itself unaltered in length, since its length would still be the same multiple of its arbitrary unit; it would have no means of ascertaining that the length of its unit had increased, because it could not compare it with other, external units, which do not expand as the temperature rises.

A human being is, as regards the mental phenomena which occur within him, very much in the position of this hypothetical piece of iron. He is at the same time the observer and the observed, that which measures and that which is measured, and his conclusions from such internal measurements may possess an individual interest but are totally devoid of scientific value, unless the measurements are of such a type that they can be repeated by other observers external to himself; can be referred, in a word, to external standards.

But, the reader may inquire, how can the tenuous entities of thought, sensation, or memory be compared with external standards and be made evident to the senses of universal humanity? How can the chasm which divides our internal, mental life from the external, material world

ever be bridged? The answer is that this chasm is imaginary; an artefact arising from our peculiar situation of being at the same time the observer and that which is observed; a delusion which, it is evident, must be the inevitable result of the existence of consciousness in any body whatsoever.

Through what are we aware that human beings other than ourselves possess, like ourselves, consciousness, the ability to feel sensations, to store up memories, to experience emotions? Simply through a thousand material signs, which we note and interpret just as we note and interpret the multitude of material phenomena which assail our senses at every moment of our life. The only reason why our mental life appears to us so sharply divided from the external, material world is that we each possess, regarding our own mental life, "inside information." Through countless sources, by way of a thousand nervous channels, a thousand minute chemical changes in our blood or in our tissues, we possess at every moment a vast quantity of information regarding the happenings in our brain or spinal cord of which the external observer is, at present, necessarily ignorant. The task which, in this territory, faces science to-day is that of inventing means of throwing open these sources of information to the senses of universal humanity; of making available for comparison and measurements phenomena as yet inaccessible, buried in the consciousness of the individual. It is this task which, as regards sensation and memory, has been successfully initiated through the labors of Weber, Ebbinghaus and their successors, and there can be no doubt that, by methods however devious or refined, we shall ultimately complete the task so auspiciously begun, not only as regards the simpler phenomena of sensation and memory but also the most complex and recondite phenomena of our mental life.[1]

[1] It is obvious that the above considerations remain equally valid whether

A detailed account of the elaborate investigations which have sprung from the researches of Weber and of Ebbinghaus would, save to the specialist, be wearisome in the extreme; but the main results, and the principles underlying these, can readily be stated in concise form.

It is a matter of every-day experience that we cannot so readily perceive a slight difference between the strength of two stimuli, when the stimuli are large as when they are small. If we hold in our hand a pound weight we do not perceive a noticeable increase in the sensation of weight upon the addition to it of a tenth of an ounce; but if the weight which we are holding in our hand is an ounce then the addition to it of a tenth of an ounce will call forth a perceptible increase in the sensation of weight. In a brightly illuminated room the light of a candle makes barely any perceptible difference to the apparent illumination, while in a dark or poorly illuminated room a candle will appear to afford considerable illumination. During the decade 1840-50 Weber published an extensive series of investigations upon the amount by which a stimulus must be increased in strength in order to produce a just noticeable difference in sensation, and his results were formulated in the well-known Weber-law, which may be expressed in words as follows: "In order to produce a just noticeable difference in the intensity of a sensation the stimulus must always be increased in the same proportion"; that is, if we can just perceive the difference between the weight of an ounce and that of eleven-tenths of an ounce then we shall be just able to perceive the difference between the apparent weight of a pound and that of eleven-tenths of a pound.

we regard the universe from the point of view of materialism or from that of psychomonism. Either point of view involves the conception of the essential identity of those phenomena which, at present, are accessible only to individual consciousness and those which are accessible to the consciousness of universal humanity. The distinction between materialism and psychomonism is therefore a mere verbal quibble, comparable with that ancient and knotty problem, whether the owl first originated from the egg, or the egg from the owl.

If we can just perceive the difference between the intensity of illumination afforded by a sixteen candle-power lamp and that afforded by a seventeen candle-power lamp, then we shall be able to just perceive the difference between the illumination afforded by a thirty-two candle-power lamp and that afforded by a thirty-four candle-power lamp. If the addition to any given weight of one-sixteenth of its amount just enables us to perceive an increase in the sensation of weight which it calls forth, then we shall have to add to any other weight whatever, the same proportion, one-sixteenth of its amount, in order to similarly call forth a just perceptible increase in the sensation of weight.

Here was the first indication of a definite mathematical law obtaining in the realm of mental phenomena; the just noticeable difference in sensation was found to be a definite mathematical *function* of the strength of the stimulus calling forth the sensation; mental phenomena were delivered over, once for all, into the hands of the scientific investigator; the law of invariable sequence had again prevailed.

But in what manner, it may be asked, does this investigation differ from the endeavor of the hypothetical piece of iron, alluded to above, to measure its own length? Who is the judge of a "just noticeable difference in sensation" save the investigator himself? The answer is that the case is very materially different from that of the hypothetical piece of iron, in that the observation is capable of reference to external standards. It is true that the *subject's* consciousness of his own sensation is a thing which cannot be measured by any other standards than his own, but the *observer's* consciousness of the subject's sensation *is* capable of being measured by external standards, because it is derived from some material sign displayed by the subject. It is this material sign or *reaction* which is actually being measured. The subject is required to say a word or tap a key which closes an electric circuit, or per-

form some other definite preconcerted signal in order to notify the observer of the fact that he has perceived a just noticeable alteration in the apparent intensity of the stimulus; but he is not conveying to the observer his own consciousness of his sensation, derived from "internal evidence" unavailable to the observer. He is, on the contrary, conveying to the observer *his* consciousness of the subject's sensation, that is, a material token, differing in no sense from the countless material tokens wherefrom we infer that our fellow beings are, like ourselves, sentient organisms, and upon which, were it not for our "inside information" regarding our own cerebral states, we should have to depend for all our cognizance of mental phenomena. But material tokens can be reduplicated, recorded, and they, or the phenomena leading to them, can be measured by universal standards; whereas our internal consciousness of our sensations cannot.[2]

In 1885[3] Ebbinghaus published a series of investigations upon memory by means of which he demonstrated that this apparently intangible quantity could also be subjected to measurement. In order to exclude the distracting influence of the associations called up by the meaning attached to *words,* he used, as material for learning, syllables each composed of three letters and devoid of any linguistic significance whatever. A variable number of syllables were repeated until the first perfect repetition was secured. In the accompanying table are given his results, although

[2] The statement which is to be found in some psychological literature, that the perception of the "just noticeable difference" in the apparent intensity of a stimulus involves a *judgment* upon the part of the subject, is simply an example of that endless series of judgments, judgments upon judgments, judgments upon judgments upon judgments, etc., the simultaneous existence of which, within his own consciousness, any one can readily persuade himself by a few minutes of introspection. Thus "I know" being granted, there can be no question that "I know that I know," while the proposition "I know that I know that I know" is equally incontrovertible, and I could not have written this had I not known that I know that I know that I know; and thus this highly unprofitable concatenation of unrealities can be extended *ad absurdum.*

[3] H. Ebbinghaus, *Ueber das Gedächtniss,* Leipsic, 1885.

he did not succeed in expressing them in the form of a definite mathematical equation.

TABLE I.

Number of repetitions until the first perfect repetition.	Number of syllables in the series repeated.
1	7
16.6	12
30	16
44	24
55	26

The services thus rendered by Weber and by Ebbinghaus to psychology consisted, however, not only in reducing certain mental phenomena to quantitative, mathematical standards, but also in pointing out methods whereby measurements can be secured under constant experimental conditions. Given a constant condition of the subject during a period of the experiment (absence of fatigue etc.) and a constant rate of increase or decrease in the intensity of the stimulus (instantaneous), the only quantities varying throughout Weber's experiment are the intensity of the stimulus and a just perceptible alteration in its *apparent* intensity. Thus we are enabled to ascertain the manner in which the one varies with the other; we are enabled to ascertain, not only that the just noticeable difference in sensation is a function (in the mathematical sense) of the strength of the stimulus (i. e., that the just noticeable difference in sensation varies when the strength of the stimulus varies), but we are enabled to ascertain the precise character of the function, to formulate it in mathematical symbols thus: $dR/R = k.dS$ where (dR) is the increase in the stimulus of strength (R) which gives rise to a just noticeable difference (dS) in the sensation and (k) is, under the conditions of the experiment, a constant. Were the experiment of such a character that the

number of variable quantities could not be controlled in the manner outlined above, so that three or more quantities varied simultaneously during the experiment, then the problem of ascertaining the *function* connecting these variables would be much more difficult or even impossible. As we have seen, Ebbinghaus, by inventing ingenious methods of measuring memory, has not only shown that quantity of memory is a *function* of the time spent in learning, which is a matter of common knowledge, but has furnished us with data which, as we shall see, enable us to ascertain the exact nature of this function. Similarly, as Loeb has pointed out,[4] instincts are functions of the tropisms, but here extended research has still to be performed in order to learn how to eliminate adventitious variables and thus enable us to ascertain the exact nature of the functions.

This is the invariable procedure of science: first, methods are found of measuring or detecting the variables involved; next, methods are sought to isolate as few as possible of these variables and determine whether, and in what manner, they depend upon one another (in other words, what *functions* they are of one another) and then to admit more variables, as few as possible at the time, in order to determine in what manner these additional variables affect the relations subsisting between those originally chosen; thus proceeding from the simple to the complex, the particular to the general. This is the reverse of the procedure of the metaphysicians who, ignoring the particular in the search for the general, forget that the general is simply an anastomosis of particulars and that our knowledge of the general is therefore necessarily conterminous with our knowledge of each of the particulars, of the functions connecting them and of the *manner* in which they anastomose.[5]

[4] Cf. J. Loeb, *Comparative Physiology of the Brain and Psychology.* New York, 1900, chap. XIII.

[5] "The aim of research is the discovery of the equations which subsist

The data obtained by the methods outlined above, alone constitute scientific *knowledge*. When we have determined, and can express in mathematical symbols, the *function* connecting two variables we have obtained all the knowledge that can be obtained regarding these two variables *per se*; but these methods alone do not lead us very far. The senses, unaided by the imagination, or by a knowledge of phenomena cognate to those under investigation, seldom, and then only by accident, perceive variables or relations subsisting between variables other than those of the most obvious description. It is here that the legitimate use of the *scientific hypothesis* is found. The scientific hypothesis is to be valued, not necessarily for its intrinsic truth, but for the fidelity with which it represents known phenomena, for the relations between variables which it indicates, for the hitherto hidden facts which it leads us to ascertain. An hypothesis is to the scientific discoverer what his telescope is to an explorer; it leads him to investigate new horizons, suggests to him possibilities beyond the reach of his unaided vision, stimulates him to fresh explorations. True, what he sees on the far horizon may only be the mirage, but he is stimulated thereby to research, and the result is that a fresh area is triangulated, a blank space upon the map is filled in.[6]

between the elements of phenomena"; Ernst Mach, "The Economical Nature of Physics," *Popular Scientific Lectures*, Chicago, Open Court Publishing Co., 1896, p. 205.

[6] It may here be pointed out, in order to remove some prevailing misconceptions regarding science, that scientific *controversy* invariably rages over *hypotheses* and not over *scientific knowledge*, i. e., ascertained facts or functions. The controversy is, however, frequently more stimulating than the rival hypotheses themselves, and may result in the unearthing of a vast body of facts which otherwise might not have been brought to light for a protracted period. Controversy over scientific *knowledge* is almost unknown to the history of science. True, observations are frequently made which are erroneous, but a subsequent observer invariably corrects the error of his predecessor. Every published experiment is repeated indefinitely, and, should difference of opinion regarding an observation exist, it is almost immediately set at rest by an overwhelming majority of affirmations upon one side or upon the other. Instances wherein *facts* have been the subject of prolonged controversy are so rare in the history of science that each instance is unique. A remarkable example of this rare class of discussion is that which took place over the so-

It is a remarkable fact that the results obtained by Weber and Ebbinghaus have, beyond a few immediate applications, done very little to extend our knowledge of the field of mental phenomena beyond that knowledge which was conveyed in the results of their own investigations. The field has been remarkably sterile, barren of suggestions and results. True, a vast number of minute and laborious investigations have been made upon the lines laid down by Weber and Ebbinghaus, but their result has been almost exclusively to confirm and amplify the results obtained by those observers. The reason for this is, I think, to be sought in the almost total absence of scientific hypotheses from the literature published by Weber, Ebbinghaus, and their successors. "The unfruitfulness of brain investigation is due, however, only partially to the difficulty of the matter. The main cause seems to be the entire absence of any working hypothesis, or even an approximate idea, as to the nature of cerebral activity."[7] Scientific investigation deprived of scientific hypothesis leads to an indefinite reduplication of similar results, an indefinite and sterile refinement of method and technique, and, finally, to the exhaustion of the field of research, until the discovery of entirely fresh methods, or the invention of hypotheses, opens up new fields of research, indicates unsuspected possibilities, relations hitherto undetected.

In what direction can we look for such a working-hypothesis in the field of psychology? As Loeb has pointed out[8] valuable clues are afforded by the tropisms. I believe that clues of equal value are afforded by the phenomena of memory; I will here only treat of the latter.

called "*n*-rays"; their existence was repeatedly affirmed and denied until the situation became intolerable and a host of investigators intervened to settle the dispute. The result of their labors was the obliteration of the *n*-rays and no one, so far as I am aware, positively affirms their existence to-day. Cf. an article by H. Pieron, "Grandeur et décadence des rayons N," *L'Année psychologique,* 1907, p. 143.

[7] F. A. Lange, *History of Materialism,* Vol. 3, p. 112.

[8] J. Loeb, *Comparative Physiology of the Brain and Psychology.*

The phenomenon which we colloquially designate memory but which, scientifically, might be more appropriately termed "associative hysteresis"[9] may be expressed thus: Certain mental phenomena occur more readily as a result of their previous occurrence. The mental phenomenon which we term the cognizance of a word renders more easy the repetition of that cognizance—we *remember* the word, that is, we can call up its image or sound so readily, after a certain number of repetitions, that we can finally dispense with the external image of the word altogether.

Various attempts have been made, of which the best known are those of Gall and Munk,[10] to explain the phenomena of memory upon a structural basis. According to these investigators each memory-image is localized in a particular ganglion-cell in the brain and is represented therein by a definite structure. This hypothesis has, however, proved completely sterile; no adequate evidence of this physical localization of memories has ever been adduced, even by its most enthusiastic exponents, while numerous phenomena are in flagrant contradiction with the hypothesis.[11] Moreover, even if such a structural modification occurs in the brain, it must be preceded by physical and chemical changes in the cerebral tissues, and it is therefore to physical and chemical phenomena that we must, whatever hypothesis is adopted, look for the origin of the memory-trace.

For various reasons, which I cannot dwell upon here, a purely physical explanation of the formation of the memory-trace must be excluded[12] and the search for a working-hypothesis regarding the formation of the mem-

[9] J. Loeb, *Arch. f. d. ges. Physiol.*, 115, 1906, p. 564.

[10] Munk, *Ueber die Funktionen der Gehirnrinde*, Berlin, 1881.

[11] Cf. J. Loeb, *Comparative Physiology of the Brain and Psychology.*

[12] Cf. T. Brailsford Robertson, *Archives Internationales de Physiologie*, 6, 1908, p. 433.

ory-trace narrows down to the question: What chemical phenomena are known which take place more readily in consequence of having already occurred? To answer this question we must make a short digression.

I have no doubt that the majority of my readers have heard of "catalysors," or, at any rate, of those catalysors which occur in the living organism and are termed "ferments"; but I suspect that very few have an accurate conception of what a catalysor *is*.

A catalysor is a substance which, when added to a mixture of chemical substances which are undergoing a chemical reaction, accelerates the reaction. It does not *initiate* the reaction, it cannot start a chemical reaction which would not otherwise occur, but it accelerates the reaction which is already taking place, by removing some resistance which hinders its progress. A catalysor is to a chemical reaction what axle-grease is to the rotation of a wheel; it removes the friction which prevents its rapid progress. The mechanism whereby the catalysor accelerates the reaction is, in most cases, perfectly well understood, and the phenomena of catalysis can be, and are, reduced to mathematical, i. e., functionalistic terms; the catalysors or ferments occurring in the living organism differ in no essential from ordinary, inorganic catalysors, and their action obeys the same laws.

A catalysor does not accelerate *every* chemical reaction; each catalysor accelerates a given reaction or group of reactions; thus zinc accelerates (i. e., *catalyses*) the transformation of alcohol into formaldehyde; finely divided gold, platinum, or charcoal, accelerate the decomposition of hydrogen peroxide into water and oxygen; acids accelerate the transformation of starch into sugar; the ferment pepsin, which occurs in the stomach, accelerates the chemical decomposition of the proteins of our food,—the list might be prolonged indefinitely.

There are certain reactions, however, which produce their own catalysors; that is, one of the products of the chemical transformation accelerates its progress.[13] It is easy to see what must happen in such a case; the reaction proceeds slowly at first but, as it continually produces more and more catalysor, it proceeds more and more rapidly until, as it approaches completion, that is, as the material undergoing transformation gets used up, the reaction gradually slows off. Thus the curve expressing the relation between the amount of material transformed, and the time, is ∫-shaped, expressing the fact that the reaction proceeds at first slowly, then more rapidly and then, again, more slowly. This curve furthermore expresses the fact that the amount of transformation is a definite function of the time, a function which can readily be expressed in mathematical terms. The essential feature of such a reaction is that it takes place more readily as a result of having already taken place to a certain extent.

Are there any indications of chemical transformations such as these occurring in living organisms? The answer is in the affirmative; the chemical phenomena underlying cell-division and growth are of this character[14] and it has been pointed out that the phenomena underlying muscular contraction are of this description.[15] As an example of such chemical transformations in the central nervous system I may cite the following.

[13] The "spontaneous" oxidation or "tarnishing" which many metals undergo when exposed to the air is a reaction of this type.

[14] As regards cell-division, cf. J. Loeb, *Biochemische Zeitschrift* 2, 1906, p. 34, and an address delivered at the seventh International Zoological Congress, Boston, Aug. 22, 1907. *Univ. of Calif. Publ. Physiol.* 3, 1907, p. 61. *Vorträge und Aufsätze über Entwicklungsmechanik*, Heft II, "Ueber den chemischen Charakter des Befruchtungsvorganges und seine Bedeutung für die Theorie der Lebenserscheinungen." Leipsic, 1907.

Wolfgang Ostwald and I independently and very nearly simultaneously pointed out that growth is also a phenomenon of this character. Cf. T. Brailsford Robertson, *Archiv für Entwicklungsmechanik der Organismen*, 25, 1908, p. 581; 26, 1908, p. 108. Wolfgang Ostwald, *Vorträge und Aufsätze über Entwicklungsmechanik*, Heft V, Leipsic, 1908.

[15] T. Brailsford Robertson, *Biochemische Zeitschrift*, Festband für H. J. Hamburger, 1908, p. 287.

It is well known that the rhythmic movements of respiration are primarily controlled by the medulla oblongata, or lower part of the brain. It is a classical fact of mammalian physiology that injury to a certain portion of the medulla results in instant cessation of respiration, and that circumstances affecting the condition of the medulla (i. e., heating, cooling, etc.) profoundly affect the character of the respiratory movements. Nearly every living tissue produces, as a result of its activities, carbonic and lactic acids, and there is no reason to suppose that cerebral tissue differs from other tissues in this particular. In fact I have shown, and others have shown, by different methods, that acid is developed in the brain as a result of stimulating sensory nerves.[16] Now it is a familiar fact that in suffocation the respiratory movements at first *increase* enormously in force and rapidity; the suffocating animal or man "gasps for breath." What is the essential feature of suffocation? The blood can, for some reason or other, no longer be ventilated in the lungs, carbonic acid gas cannot escape from the body and, consequently, the concentration of carbonic acid in the blood and in the tissues increases. As we have seen, the result of this is an increase in the velocity and force of the respiratory movements, and it is an obvious possibility that this increase in the rate of the respiratory movements is due to a direct action of the carbonic acid in the blood upon the tissues of the medulla oblongata. When one acid accelerates a chemical reaction others usually do so, and, in confirmation of the view expressed above, I have shown that when dilute acids are directly applied to the medulla of a frog, a marked increase in the rate of its respiratory movements takes place, often amounting to several hundred percent.[17] Here we have

[16] T. Brailsford Robertson, *Archives Internationales de Physiologie* 6, 1908, p. 388.

[17] T. Brailsford Robertson, *loc. cit.*

an obvious parallel to the self-catalysed chemical reactions described above. Acid is produced in the activity of cerebral tissue and acids accelerate its activity.

Here we have, also, the obvious suggestion of a working-hypothesis of memory. During the perusal, for example, of a printed word, acid is produced in some portion of the cerebral tissue, hence the word is more readily repeated until, after a certain number of repetitions, we can dispense with the external stimulus of the printed word and repeat the process of cognition spontaneously.*

It is easy to show, but I will not here venture upon the necessary mathematics, that, for a limited number of syllables, it follows from the above hypothesis, namely, that the extent of the memory-trace is proportional to the amount of material transformed in a self-catalysed chemical reaction, that the number of syllables memorized must be connected with the number of repetitions (or time of learning) according to the following function:

$$\log n = Kr + b$$

where n is the number of syllables memorized, r is the number of repetitions, and K and b are constants (that is, do not vary when n and r vary).

We have seen that the measurements of Ebbinghaus have placed in our hands exact data concerning the dependence of the number of syllables learnt, upon the number of repetitions. For a given number of repetitions we can, from the above formula, calculate how many syllables should, were our hypothesis correct, be memorized—in the following table these theoretical deductions from our hypothesis and the data actually obtained by Ebbinghaus are compared:

*) Since the above was written I have found that Wilh. Ostwald (*Vorlesungen über Natur-Philosophie,* Leipsic, 1902, p. 368) had previously put forward a suggestion embodying the germs of a theory of memory somewhat resembling that herein described.

TABLE II.

r = number of repetitions.	n = number of syllables memorized (observed)	n = number of syllables memorized (calculated)
1	7	8.33
16.6	12	12.06
30	16	16.57
44	24	23.11
55	26	29.99

Data similar to those obtained by Ebbinghaus have been obtained by W. G. Smith[18] who, however, used methods of investigation differing somewhat from those employed by Ebbinghaus. In the accompanying table the figures deduced from the above formula and the data actually obtained by Smith are compared (Since these data are each the mean of a large number of determinations they are expressed as syllables and *fractions* of syllables):

TABLE III.

r = number of repetitions.	n = number of syllables memorized (observed)	n = number of syllables memorized (calculated)
1	2.2	2.21
3	2.5	2.46
6	2.8	2.87
9	3.4	3.35
12	3.9	3.92

It will be seen that the calculated and the observed figures agree closely. Our hypothesis has already borne fruit. It has enabled us to anticipate the exact nature of the hitherto undetermined function connecting the amount of material memorized and the time of learning, and our anticipations have proved correct.

It can also be easily shown, but again I will refrain from the mathematics involved, that, provided our hypothesis were correct, the Weber law of sensation would ne-

[18] W. G. Smith, *Psychol. Rev.*, 3, 1896, p. 21.

cessarily follow; the Weber law therefore affords additional confirmation of the hypothesis.

One more illustration of the possible applications of the hypothesis and I will conclude. Every stimulus takes a certain time to be perceived; when we touch a red-hot coal we do not, as we imagine, instantly perceive the heat. Minute as the interval is between the application of the stimulus and its perception, it can nevertheless be accurately measured by the exact methods of experimental psychology. It can readily be shown that, were the above hypothesis correct, the period required to perceive a stimulus (for stimuli not too intense) should be connected with the intensity of the stimulus according to the following function:

$$t = A + \frac{B}{i} - \frac{C \log i}{i}$$

where t is the time required to perceive a stimulus of intensity i and A, B and C are constants, that is, do not vary when t and i vary.

Cattell[19] has published a number of observations upon the time required for a color to be correctly perceived; his results for one subject and with orange light are compared, in the following table, with the deductions from the above formula, the time is given in thousandths of a second.

TABLE IV.

Intensity of the light	Time required to correctly perceive (observed)	Time required to correctly perceive (calculated)
I	.9	.9
¼	1.1	1.0
1/16	1.25	1.25
1/64	1.75	1.8
1/256	2.5	2.4

The time required to read a page of a given size of print which is illuminated by varying intensities of light is

[19] J. McKeen Cattell, *Philosophische Studien*, 3, 1886, p. 94.

connected with the intensity of illumination according to the same formula, as the following table shows[20]:

TABLE V.

Intensity of illumination	Time required to read column of pearl type (observed)	Time required to read column of pearl type (calculated)
11.2 candle-meters	36 seconds	36 seconds
2.8 " "	36 "	36 "
.7 " "	46 "	46 "
.35 " "	63 "	64 "
.17 " "	110 "	110 "

The psychologists of old endeavored to unravel the tangled skein of mental phenomena through the unaided exertions of their intellect, and they succeeded only in rendering "confusion worse confounded." The modern psychologist has devoted himself almost wholly to measurement and description, and he has succeeded in measuring with the utmost refinement, it is true, a limited number of phenomena, but his field of investigation has been narrow, his horizon contracted. It appears to me that by a well-balanced combination of the two methods, by a judicious admixture of scientific hypothesis as a guide to scientific observation, we may hope to achieve, in the not too distant future, a scientific knowledge of mental phenomena not incomparable with our knowledge of phenomena of the external, material world.

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[20] Constructed from data published by Griffing and Franz, *Psychological Review*, 3, 1896, p. 513. The data quoted are those which were obtained with subject H. G.

PSYCHOLOGY A DOMAIN OF ITS OWN.

WITH REFERENCE TO THE BIOCHEMICAL INTERPRETATION OF MENTAL PHENOMENA.

PSYCHICAL activity so obviously constitutes a class of its own that it has been regarded as radically different from any other natural phenomenon. Here lies the basis of all dualism, and here if anywhere must be sought its justification, which however is only relative. A close study of the situation leads to a monistic conception, but while monism removes the contradictions of dualism, it can not and should not slur over the contrasts of nature which actually exist.

Psychical phenomena are different from any other kind of natural happenings and it would be vain to deny it. Nevertheless there have always been advocates of a one-sided monism who claim that psychical activity can be and has to be explained from physical, or chemical, or perhaps biochemical facts; that therefore psychology should be regarded as a branch of physics and that from physics or chemistry we shall have to expect the solution of psychical problems. This view is quite common among a great number of naturalists and we deem it proper in the interest of our readers to have it presented in our columns by Mr. Robertson of the University of California, who in his line has done good work, but while the results of his labors may prove valuable in biochemistry we do not expect that they will contribute anything toward the solution of psychical problems.

It is perhaps natural that men of Mr. Robertson's type would look upon my views as inconsistent and think that theirs alone are truly scientific and monistic. On a superficial inspection my proposition appears dualistic, so I will here set forth my reason why I deem the naturalistic monism (as it might fitly be called) insufficient and untenable.

Not without satisfaction I note that among scientists, thoroughly familiar with chemistry and physics, Rignano makes a praiseworthy exception in that he most vigorously insists on psychology being *sui generis* and as different from physics as e. g. electricity is different from chemistry. We go further still and say that psychology being the science of the phenomena of the domain of subjectivity, has a character of its own different from all the sciences of objective phenomena, mechanics, physics, chemistry and physiology. This of course does not exclude that occasionally and in very important details these sciences will throw light on the mechanism or objective conditions of feeling and thinking, but they will never explain the properly psychical or subjective phenomena of the soul. Incidentally we will add that if Mr. Rignano had been familiar with the philosophy of form or the philosophy of science, as our view of monism may be fitly called, he would have been helped in working out his own theory and might have both deepened and broadened it.

We can not satisfactorily explain our objections to Professor Robertson's position without going over the whole field of psychological problems, but on account of their paramount importance we gladly take this opportunity to recapitulate our views in a concise form.

THE IMPORTANCE OF PSYCHOLOGY.

The laws of nature are the same for the whole realm of existence, yet we must recognize that there are differences of conditions, and we can classify different kinds of

phenomena according to their characteristic features into distinct groups. One of the most obvious divisions is the distinction between organized and unorganized nature, the latter consisting of the purely physical domains of existence and the former comprising all the phenomena of life, vegetal and animal, reaching its climax in the development of humanity.

If the whole of existence is one, we can not look upon the development of life, of animation, of consciousness and of rationality as some accidental by-play, but on the contrary we must regard soul, spirit, mind, or whatever you may call it, as the necessary outcome of the intrinsic nature of existence. Nevertheless organized life constitutes a domain of its own and within this domain the group of psychical phenomena is again a province with distinct characteristics which are absent in the domain of inorganic nature.

The attempts to explain psychology from physics or chemistry must therefore be futile, for the very elements of psychic life (the significance of subjective states) are not met with in those fields where the objective conditions alone (which are always matter in motion) are an object of investigation, viz., in molar mechanics, physics, chemistry and electricity.

A view of the world based alone upon physics and chemistry or in general upon the science of objective nature will always prove a failure, for it will never explain the soul. Thus we must invert the process and expect a solution of the world problem not from the lowest forms of existence but from its highest efflorescence. We must recognize the import of subjectivity which though apparently absent in pure physics, reveals itself in the consciousness of man, the noblest product of organized life.

If we want to understand the mechanism of objective nature in its complications, in its growth, in its wonderful

details, we must start with the simplest phenomena; but if we would like to know the meaning of the whole, the direction in which nature tends and the aim which by an intrinsic necessity it pursues, we must consider the highest phases of its evolution, for thus alone can we realize the potentialities that lie latent in the cosmic conditions.

Here lies the paramount significance of psychology, and we do not hesitate to say that the way in which the psychological problem is treated in a philosophy is always the best test of its worth.

THE DOCTRINE OF PARALLELISM.

The doctrine of parallelism has been generally accepted in psychology, but it must not be interpreted in a dualistic sense. There are not two separate factors, the psychological and the physiological, running parallel to each other, but there is one reality which has two aspects,—the one being the internal or subjective, the other, the external or objective. The two are as inseparable and yet different, as the internal and the external curves of a circle.

The character of the subjective domain exhibits the phenomena of sentiency, feeling, awareness, consciousness and self-consciousness in different degrees, beginning with the absolute zero of feeling and rising up to the concentrated attention of a rational being. The character of the objective domain is motion, gravity and momentum; chemical reaction, heat, electricity, vitalism, physiological functions and the action of premeditated purpose. The inner aspect of subjectivity always corresponds to the outer aspect of objective events. Both form a unit, and are mutually determined, or properly speaking, they are the same in two aspects. It is a parallelism of aspects, but not a parallelism of two independent realities.

I know that feeling is a reality, for I am feeling. I myself, as I am known to me, consist of feelings and so we

may say that feelings are the surest and most indubitable reality. Motion on the other hand is the object of my observation. I take note of changes that are taking place; they are modifications of my own being, the causes of which mostly do not originate in me, but are thrust on me and constitute otherness, or something thrown up against me—such is the literal and original meaning of the Latin word *objictum* derived from *objicere*. Hence their whole domain is called objectivity.

Our own body is part of the outer objectivity and only our feelings are subjective, yet these feelings animate the body and suggest at once that body and feelings belong to each other as outside and inside of the same thing.

The contrast between subjective and objective phenomena becomes most apparent in the fact that we can feel our own feelings, not those of others. We can see the motions that, judging from our own condition, we assume to accompany other creatures' feelings, but their feelings themselves can never become objects of observation or inspection. As feelings they are and remain forever subjective.

The two aspects are radically different, for feeling is not motion, nor is motion feeling. The soul is not body, and the body is not soul, but they are one, of which the soul is the inner, and the body, the outer aspect.

* * *

Such is the doctrine of parallelism in its monistic interpretation, which, however, leaves the question of the nature and origin of consciousness open, and here I offer an explanation which, briefly stated, is this: Every objectivity has its subjective aspect, and is possessed of the potentiality of developing into actual feeling; but the subjective interior of purely physical phenomena cannot be ensouled with anything like actual feeling or awareness or conscious-

ness, because its inner commotions or subjective states remain isolated. Isolated feelings are not feelings in the proper sense of the word. In order to be actually felt, they must internally enter into a relation so that one feeling meets another feeling; two or several feelings must co-operate, so as to let one feeling feel the other. One feels while the other is being felt, thus producing the possibility of an interaction between several subjective states among themselves. Thereby alone can the feeling of a contrast originate, and only through the feeling of contrasts can a state of awareness result, yet any such internal interaction of feeling is possible only through organization.

This explanation tallies with facts established both by biology and by physiology, for we know that consciousness is always associated with a nervous system originating in these organisms which are moving about. Stationary organisms have to wait for the satisfaction of their needs, but a motor-endowed creature is enabled to go in search for food. In this way its organs learn to co-operate, and this imposes upon them unity of purpose. The unity of purpose produces the unity of the soul.

The characteristic distinction of living beings, when compared to physical phenomena devoid of life, is organization in so far as it renders possible a co-ordination of subjective states. Vitality is not a special force or substance; it is solely the function of organization, but as such it is a phenomenon *sui generis* and different from the forces of physics, chemistry, electricity or molar mechanics.

MEMORY THE PRESERVATION OF LIVING FORMS.

The typical feature of organization is the constant change of material which takes place in living substance. It is called metabolism, and in animal substance consists of a building up or anabolism, and a partial breakdown of the energy thus stored up, called catabolism. Anabolism

is nutrition; it changes food into living substance, a process called assimilation. Catabolism in setting energy free renders motion possible and this motion has under certain conditions its subjective aspect, which means that it is accompanied with feeling.

The partial breakdown of living structures called catabolism is not always the same but varies in form, depending upon the circumstances under which it takes place. It is a reaction upon a stimulus, and the reaction upon ether waves or light, air waves or sound, upon a touch of chemicals (as in taste or smell), or upon mechanical impacts are different physiologically as well as psychically. In other words: The irritation of light will produce one kind of structural change, while the irritations of sound and of touch cause other modifications, all of them being analogous; the same kind of cause corresponds to the same kind of physiological function, and each function possesses a form of its own and is accompanied by a feeling peculiar to itself.

Here the great significance of form for the explanation of life and of the soul becomes manifest. The *psyche* with its mentality, its reason, its purposes, its ideas, etc., would not be possible, if organization did not involve a preservation of form.

The waste material of a catabolic breakdown (mostly carbonic acid) is discarded, while through the anabolic process of nutrition the lost elements are again restored in the living substance, and this is done in such a way as to preserve the structure in its minutest detail. Thus the modifications produced by the reaction upon the several stimuli remain and constitute so-called vestiges or traces. In so far as this preservation of the form of living substance is accompanied by feeling, and as former feelings can be revived on the application of proper stimuli, it is called memory.

Memory, as Hering has pointed out, is a property common to all living substance; it is the indispensable condition of the development of the soul. The differentiation of nerve activity into the senses with its several modes of reacting upon the stimuli of the outer world, is due to a specialization of the several reactions in different spots, and this specialization becomes permanent through memory, which means through a preservation of the forms of the several reactions.

For a comprehension of psychology, viz., for our knowledge of subjective phenomena, it is quite indifferent what biochemical processes are its physical accompaniments; whether it is acid as Professor Robertson tells us which serves as a kind of axle-grease for the wheels of memory, or a salt or any other chemical. If we knew the whole chemistry of the brain it would throw no light on the slightest psychic action or mental process. Bio-chemistry can only solve the problems of the bio-chemical conditions of the brain and has nothing whatever to do with the mind as such. This statement does not involve a dualistic interpretation of mental phenomena but only demands the distinction between the spheres of subjectivity and objectivity which, though two aspects of one and the same reality, are after all radically different in their nature.

All events, states, and facts in this world are interrelated or correlated and all of them form one inseparable universe. But for that reason science distinguishes between different aspects, different features, and different qualities, and focuses its attention on one in order to comprehend those features which at the time are to be investigated. We have to obey this rule also in psychology, and thus the attempt to explain psychical phenomena from the physical facts would be about the same as to expect a demonstration of the Pythagorean theorem from experiments in chemical affinities. The attempt at solving

psychological problems from biochemistry would be about on the same level as if an art critic insisted that in order to explain the composition and meaning of Raphael's Sistine Madonna he would have to make a chemical analysis of the paints and the canvas Raphael used. The spirit of a book is not in the paper or printer's ink, and the soul of a man is not his body nor his cerebrum. The soul of a man is the meaning which his sentiments possess and the purposes which he pursues in life.

It is true that the investigation of the biochemical conditions of the brain will prove of great interest and will help us to better understand the nervous mechanism, but the nature of mental processes and their problem will remain the same as before.

Physicists are frequently in the habit of condemning even legitimate psychical investigation as metaphysical, and there are not a few who would regard psychology as only a branch of physiology. With reference to their claims we will say that they are frequently unfair to psychologists and misrepresent their views. For instance Professor Robertson speaks of the old metaphysical view as "the dualism which regards the mind as a species of gaseous vertebrate dwelling within, but not, or only in a minor degree, subject to the physical and chemical laws which govern our material body."

Even Thomas Aquinas would have demurred to this representation of his conception of the soul, and we would remind Mr. Robertson of the fact that the expression "gaseous vertebrate" has never been used seriously by any one who holds the dualistic soul-conception, and is merely a joke which Haeckel once made when referring to the anthropomorphic God-conception. An expression which is made as a jest can certainly not be used to describe the characteristic feature of a view to be combated.

Professor Robertson refers to the remarkable fact that

the results obtained by Weber and Ebbinghaus, with the exception of a few immediate applications, have done little to extend our knowledge of the field of mental phenomena and he believes, following Loeb, that "valuable clues are afforded by the tropisms" and further "that clues of equal value are afforded by the phenomena of memory."

As to the significance of memory we agree, but Professor Robertson instead of explaining memory (as we do) as a preservation of form, regards the processes of memory as physical and chemical phenomena, and compares the reaction of memory to catalysors which act in such a way as to make the reaction quicker by repetition, and this is done through the formation of acids. He says: "Here we have, also, the obvious suggestion of a working hypothesis of memory; during the perusal, for example, of a printed word, acid is produced in some portion of the cerebral tissue, hence the word is more readily repeated until, after a certain number of repetitions, we can dispense with the external stimulus of the printed word and repeat the process of cognition spontaneously."

Professor Robertson's reduction of this statement, to a mathematical formula, $\log n = Kr + b$, where n is the number of syllables memorized, r the number of repetitions, and K and b constants, may be very imposing to the general reader but adds nothing to the explanation of the phenomenon itself.

In spite of the merits of Professor Loeb especially in the line of physiological experiments, in which specialty he has distinguished himself, we can not see that psychology would be helped by calling some definite reactions which take place under some definite conditions "tropisms." We do not gain a scientific comprehension of these transactions until we gain an insight into the mechanism which upon a definite irritation causes organized life to move in a special direction and in a special way. New names do not explain,

however learned they may sound and we are little helped if memory is henceforth "scientifically and more appropriately" termed "associative hysteresis." The reason why psychological laboratories have added so little to our psychological knowledge is in my opinion the wrong notion upon which the experiments are based, that the soul can be measured quantitatively, and though measurements are quite helpful in many respects they will never throw light on the soul itself whose very character is of a qualitative nature. I know very well that the idea is quite common among certain naturalists that the notion of quality is not to be tolerated in science and that every problem is ultimately of a quantitative nature, but we demur and have set forth our reason in a special article, entitled "The Significance of Quality," which has been published in *The Monist,* Vol. XV, p. 375.

MEMORY THE SOUL BUILDER.

The most important service of memory is the part it plays in building up the soul. Memory creates the condition which begets the soul and then continues its further growth by adding and superadding new mental riches to its capacity.

First of all memory renders possible comparisons between the traces of past impressions and new sensations. Every memory image possesses a form of its own, and a sense-impression of the same kind travels on the path of its forerunner and revives its analogous memory trace which results in a feeling of sameness. The new sensation fits into the trace of the old one and is felt to be of the same kind. This feeling of sameness implies an act of recognition whereby the sense-impression gains meaning; and thus sense-impressions of the same kind come to represent the objects which cause them.

Here we have the principle from which we derive the

explanation of the soul, for the soul consists of feelings which have become representative of things, conditions, experiences, etc. In order to solve the problem of the origin of the soul we must show how sentiency acquires significance. Certain feelings come to stand for certain objects. They represent them. The living ideas of a man are sentiments freighted with meaning and the soul is a system of sentient symbols.

This solution looks very simple and it is simple indeed; but how grand and infinitely complicated are the corollaries implied. Consider that a symbol, or a representative meaning, is what it is by its relation to an objective reality, which may be a concrete object, a condition or a general feature of many objects, or a universal truth. There are false symbols and there are true symbols, and these symbols are not merely pictures of actualities, but also of aims, of aspirations, of ends to be attained. They have a pragmatic tendency. They possess moral or religious values, and these values may be true or false. They may lead in the right or in the wrong direction; they may be in agreement with the constitution of the All or they may be, as it were, out of tune. They may be more or less an incarnation of the world-order which sways not only stars and motes but also guides the thoughts and sentiments of man; and here we have a test of progress. Progress is not (as Spencer has it) "a passage from the homogeneous to a heterogeneous state," but the realization of truth. Progress means growth of soul, and growth of soul means growth of truth. The more clearly, correctly and completely truth is mirrored in a man, the higher he ranges in the scale of evolution.

EDITOR.

CRITICISMS AND DISCUSSIONS.

EASY NON-EUCLID.

In England Euclid is used as a synonym for elementary geometry. Let us use non-Euclid for elementary synthetic non-Euclidean geometry.

In ordinary Archimedean geometry, if we know the angle-sum in a single rectilineal triangle, we know whether the geometry be Euclidean or non-Euclidean; if the sect from the vertex of the right angle to the mid-point of the hypotenuse partition a right-angled isosceles triangle into two congruent right-angled isosceles triangles, which it does if that sect be half the hypotenuse, then space is Euclidean.

At last then we are able to understand, to marvel at the prophetic, the mystic clairvoyant genius of Dante, the voice of ten silent centuries, in connecting with the wisdom of Solomon and the special opportunity vouchsafed Solomon by God, a question whose answer would have established the case of Euclidean geometry seven centuries before its birth, or the case of non-Euclidean geometry three thousand years before its creation by Bolyai.

1 Kings iii. 5 is: In Gibeon the Lord appeared to Solomon in a dream by night: and God said, Ask what I shall give thee.

Then says Dante of his asking,

> "'Twas not to know the number in which are
> . . . . . .
> Or if in semicircle can be made
> Triangle so that it have no right angle."
> [O se del mezzo cerchio far si puote
> Triangol si, ch'un retto non avesse.]
> Par. C. XIII, 101-102.

How unexpected, how startling this! Ever overlooked, yet now when found how strangely reinforced by Dante's ranking in

the fourth canto of the "Divina Commedia," with Cæsar, greatest of men, among exalted personages

> "....who slow their eyes around
> Majestically moved, and in their port
> Bore eminent authority,"

Hippocrates of Chios who squared the lune, nearest that ever man came to the quadrature of the circle until finally Bolyai squared it in non-Euclid and Lindemann proved no man could square it in Euclid; and then Euclid himself, the geometer, the elementist, preemptor, by his unprovable postulate, of the commonly credited universe, Euclidean space; and then Ptolemy, first of the long line of those who have tried by proof to answer the question Dante says Solomon might have asked God and did not, a question crucial as to whether Euclid's or Bolyai's space holds the actual world, the real thing.

Of course the treatise of the great astronomer, purporting to prove the parallel-postulate, miscarried, and hundreds after him spent in vain their brains in like attempts. What vast effort has been wasted in this chimerical hope, says Poincaré, is truly unimaginable.

Yet according to my genial friend Francis C. Russell, it is all so easy that he is only prevented from letting out the secret by fear lest he offend!

In the last number of *The Monist,* April, 1909, p. 294, he says: "The proof that the two secondary triangles are exactly equal to one another, that they are right-angled and isosceles.... is so simple in more than one way, that it would be almost an imputation upon the reader to spread it before him."

By what he does spread before us let us judge of the quality of his supposed proof. He prints from Lobatchevsky: "24. The farther parallel lines are prolonged *on the side of their parallelism,* the more they approach one another." Yet he misses the point, that in this non-Euclid, parallelism is a *sensed* relation. As shown by Lobachevsky's very first figure, which he reproduces, page 291, through every point two intersecting straight lines are parallel to the same straight line in opposite senses. How then could any one pervert the theorem "15. Two straight lines which are parallel to a third in the same sense (toward the same side) are also parallel to one another" into applying to two straight lines parallel to a third in opposite senses? Yet this he solemnly does, saying, p. 302, "This looks to me very much like a proof that in all cases the angle of

parallelism is a right angle," and then impales himself on the following *reductio ad absurdum*: "Now by the very same course of deduction the line KAK′ is shown to be parallel to HAH′ and to EAE′, in spite of the rather important feature that they cut one another at A."

With this before us, I think we can never hope from Mr. Russell a validly justified answer to Dante's question for Solomon, but his article is interesting if only for its very liberal quotations from the only English translation of Lobatchevsky, now rare, and for its amplification of a definition of the plane and the straight line given in 1904 as § 59, p. 29, of the first edition of Halsted's *Rational Geometry*.

The article is as follows: "59. If A, B, C be any three points not costraight, then (by the method used in 58) we can construct a point B″ such that AB″ is identical with AB and CB″ is identical with CB:

"Therefore a point D such that no other point whatsoever, say D″, gives AD″ identical with AD and CD″ identical with CD, must be costraight with AC."

The following have been given as definitions:

"If A and B are two distinct points, the straight AB is the aggregate of points P for none of which is there any point Q such that QA is identical with PA and QB identical with PB.

"If A, B, C are distinct points not costraight, the plane ABC is the aggregate of points P for none of which is there any point Q such that QA is identical with PA, QB identical with PB, and QC identical with PC."

Since in the book no use is made of the parallel postulate until after this article, we see Mr. Russell was mistaken in saying we have no applicable criterion showing that his straight, Euclid's and Lobatchevsky's are one and the same. But of course the alternative deduction he gives lacks this advantage, since in it he has unconsciously assumed the parallel postulate, assuming that every three points are costraight or concyclic. He also makes the unnecessary assumptions of the compasses (Halsted, *Geom.*, Appendix II, and Euclid I, 20, etc.).

Our *sects*, point-pairs alike or differing as to congruence, he calls intervals, our definition he speaks of as "a definition which so far as I know is a new one," and in trying to show "how the ruler may be derived by means of the compass (*sic*) alone," he does not

know that we have supplanted the compasses by a far simpler instrument, the sect-carrier, and that again by the unitsect-carrier.

GEORGE BRUCE HALSTED.

GREELEY, COL.

CONSTRUCTION OF THE STRAIGHT LINE.

IN COMMENT ON MR. FRANCIS C. RUSSELL'S ARTICLE[1] "A MODERN ZENO."

Mathematicians will take an interest in Francis C. Russell's attack on the mathematical system of Lobatchevsky, whom he calls a "modern Zeno." If Mr. Russell is right we shall have to grant that there is a flaw in the arguments of Lobatchevsky on which he bases a new geometry that in contrast to Euclid's does not acknowledge the postulate of parallel lines.

Mr. Chas. S. Peirce in a letter to Mr. Russell thinks that he (Mr. Russell) overshot the mark. He says: "Those two lines cutting each other are *not* parallel and his (Lobatchevsky's) defining them as parallel to the third was in obvious contradiction to the proposition that two straight lines both parallel to a third are necessarily parallel to each other. I press the question, Why did you not content yourself with this obvious proof of the incorrectness of his proposition No. 25? The answer seems to me obvious. If you had done that your readers would have at once perceived that Lobatchevsky merely made a slip of the pen and *meant* that two straight lines parallel to a third *toward the same side* are parallel to each other."

Though Mr. Russell may have gone too far, he has called attention to a mistake which ought to be corrected, and Mr. Charles S. Peirce, in thoughtful consideration of the difficulty which puzzled Mr. Russell, points out the flaw.

But metageometricians are not so considerate. They claim that he has thoroughly misunderstood non-Euclidean geometry. We publish in the present number two criticisms, one by Professor G. B. Halsted, the other by W. H. Bussey, assistant professor of mathematics at the University of Minnesota.

Metageometricians are a hotheaded race and display sometimes all the characteristics of sectarian fanatics. To them it is quite clear that there may be two straight lines through one and the same point which do not coincide and yet are both parallel to a third

[1] See the April number of *The Monist.*

straight line. I do not mean to take issue here for either Euclideans or non-Euclideans but I wish to say that the subject is difficult, that mathematicians are by no means so positively agreed on the subject as some metageometricians claim. If Mr. Russell is wrong, the admirers of Lobatchevsky are welcome to point out the mistakes in his objections. Mr. Russell has made no positive assertions, he has expressed his incredulity as to the soundness of Lobatchevsky's arguments and asks for further information on the subject. The problems of non-Euclidean geometry are not quite so simple, nor the solutions of Lobatchevsky so self-evident that a modest question on the subject would not be in order; but the editor is seriously requested to submit manuscripts to a mathematician (presumably an orthodox non-Euclidean) and to suppress all heretical articles. In reply to this request I will state that I frequently publish articles setting forth views which I do not endorse, because I believe that they are worth being noticed, considered and perhaps refuted. Mr. Russell, for instance, raises another issue (viz., the problem of a construction of the straight line) on which the greatest mathematicians have made the most divergent statements.

Leaving the discussion of Lobatchevsky's geometry to the non-Euclideans I wish now to criticise Mr. Russell for his construction of the straight line.

Mr. Russell attempts to define and develop the straight line by purely *a priori* methods and does it without the ruler, limiting his method to the use of the compasses. He constructs three spheres, and by the use of the compasses only he lays down a range of points which in their totality mark a straight line. Incidentally he refers appreciatively to my book on the *Foundations of Mathematics,* and I gladly note many points of agreement which, however, Mr. Russell has worked out in perfect independence. Like myself Mr. Russell calls attention to the significance of even-boundary conceptions the value of which consists in their uniqueness, and he is pleased with the term "anyness"; but I would suggest that if he had adopted my view of the foundation of mathematics, he would have deemed it redundant to construct the straight line as he does, and would be satisfied to produce it (as I have done) as an even-boundary conception; for after all he shares the mistake of all attempts of the same kind, in that while constructing the straight line, he presupposes it. He says most impressively when speaking of the indispensableness of the straight line (and I subscribe to every word of it): "All things in mathematics have been made by it and without

it has not been made anything that has been made." But even while making the statement Mr. Russell forgets this truth for a moment and inadvertently proves it in his very construction of the straight line, for he presupposes and uses conditions which involve the straight line, while he attempts to lay it down with the help of the compasses.

The same idea, at least in its principle, has been suggested before by Fourier who proposed a new construction of the straight line in the following way. We quote from an article by G. B. Halsted in *The Monist,* IV, p. 485:

"Take any two points on any solid. Let one remain at rest while the solid moves. The other describes a sphere. Two spheres intersect in a circle. If the spheres are equal and grow, this circle describes a plane. If the spheres touch and one decreases as the other grows, their point of contact describes a straight."

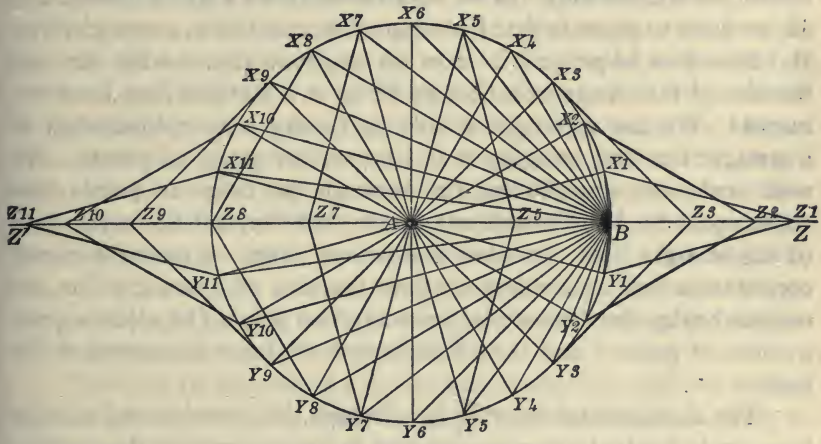
Fourier's construction of the straight line suffers from the same faults as that of Mr. Russell. Both presuppose the straight line, both are constructed in a homaloidal space, under conditions of anyness, which renders the distance between two points definite. This definite distance between two points is determinable (i. e., measurable) only by a straight line. If we could not measure distance so as to be sure that it does not change while the moving point travels around the stationary point, there would be no use of the construction.

Almost every metageometrician remains unaware that everything he does he accomplishes through the instrumentality of the straight line, and that the straight line is indispensable even if we draw a circle. Here we have good evidence of Mr. Russell's dictum concerning the straight line, that "all things in mathematics have been made by it and without it has not been made anything that has been made."

Mr. Russell, as well as M. Fourier, starts with the construction of a sphere and naturally makes use of the radius. But what is the radius but a straight line, the straight line being the measure of the distance between two points? When we lay down two points at a definite distance we imply the straight line which is our only means of uniquely, i. e., unequivocally, determining distance, otherwise we have no means to distinguish radii of different lengths. It is evident that these two constructions, Mr. Russell's and M. Fourier's as well as all others which produce the straight line by some such legerdemain, presuppose the notion of an even space, or of distance that remains

the same, or of a scope of motion under conditions of anyness. All three being different expressions for practically the same thing.

The issue which I raise is no quibbling and will be driven home to the reader who would try to construct the straight line with a pair of compasses that are not firmly set. He will have again and again to assure himself that the distance has remained the same. When we construct circles we presuppose an even (or homaloidal) scope of motion. We presuppose that distances are definite and measurable. We presuppose the existence and workableness of the compasses. The ruler is first and the compasses second. The circle, being begotten of the radius, presupposes the straight line. In fact the compasses determine the size of a straight line, for the essential part of the compasses consists in the adjustability of its two points,



not in the two legs. The two legs are merely a convenience. They are the machinery to fix the points and a handle to turn them in their fixed position. We might as well use a string pinned down at one end and having a pencil at the other; and what is a string stretched tight if not a materialization of the straight line?

We here reproduce Mr. Russell's diagram which shows on two circles what he proposes to do with three spheres for the sake of developing the straight line by means of the compasses only and without the ruler. In order to show the several openings of the compasses used, he draws the radii and thus makes visible what they involve. Just look at all these straight lines which are here introduced as auxiliary constructions, and there are still more of them doing obstetrical service for the birth of the straight line from the

cooperation of the three spheres. The very spheres themselves have been begotten by the straight line, which first performing the function of a radius, made one end stay in one place (the center) and let the other swing around it; then having created the circle it was again the straight line which as a diameter of the circle served as an axis of its rotation so as to produce the sphere. Verily Mr. Russell is right and we repeat his proposition with religious solemnity. All things in mathematics have been made by the straight line.

Mr. Russell's contention would be proved only if he could make his construction with the circle alone and dispense with the ruler entirely; he should also dispense with it in his proof. But he can not. His construction does not create a straight line; in fact it creates no line at all, but only (as he says himself) a range of points, and all we have to grant is that his range of points lies in a straight line. But how does he prove it? How do we know and in what way can the site of this range of points as being in a straight line, be determined? We can determine it only by having a clear conception of a straight line and bringing it to bear on our range of points. We must make the straight line run through the range of points thus constructed by Mr. Russell and prove that they all lie in the path of the straight line. In other words, any range of points does not constitute a line, and unless we have the idea of a straight line, we can not bridge the distance between any two points (let alone a great number of points) and then declare that we have accomplished the task.

The fundamental error of Mr. Russell, M. Fourier, and all who have made kindred attempts, consists in the assumption that mathematics has to start from a blank and is an *a priori* construction out of nothing. Mathematics starts from an absence of all concrete existence, and this can be called "nothing" only in a certain sense. The domain of mathematics is a nothingness in the sense of an absence of all materiality, of all forces, of energy, of all bodily existences, and of all concreteness. As I have expressed it in my *Foundations of Mathematics,* the mathematician starts from a state of "anyness" and this absence of all concrete existence is not an absolute nothing. Anyness involves homogeneity and homogeneity is the characteristic feature of mathematical space—the scope of motion for the mathematician's operations.

The mathematician performs operations, but his operations are pure motions of anyness, which means they are stripped of all par-

ticularity and concreteness. They are devoided of matter and energy with all their qualities. Thus the determination of a locus is a mere point without extension and its motion produces mere length without breadth or thickness, etc. Everywhere we meet with that subtle fabric of anyness which is a true nothing in the sense of the absence of everything concrete, but not an absolute nothing. In this anyness the mathematician operates and his mode of operation is a work of anyness.

Mathematical space which is the domain of anyness in which the mathematician performs his operations, includes the possibility of constructing even boundaries, and even boundaries are needed for mathematical constructions on account of their quality of being unique. Uniqueness is needed in order to have a standard of reference. The three even boundaries which thus recommend themselves by their uniqueness as standards of reference, are the straight line, the plane, and the right angle, and they make it possible to construct parallel lines. Accordingly it is obvious that the problems of the straight line, of the plane, of the right angle, of the sum of the angles in a triangle as equal to two right angles, and of parallelism are practically the same problem, and it is impossible to construct any one of them from nothing with the help of pure logic only. In addition to pure logic, the mathematician needs for the construction of his science the concept of anyness which yields that most indispensable quality of mathematical space, homogeneity without which mathematics would be impossible.

This idea of anyness is a product of abstraction and the mathematician should know its origin as well as its application in order to understand the foundation of his science.

EDITOR.

SOME REMARKS ON MR. RUSSELL'S ARTICLE, "A MODERN ZENO."

I have been reading with interest the April number of *The Monist,* especially "The Choice of Facts," by H. Poincaré, and "A Newly Discovered Treatise of Archimedes," by J. L. Heiberg. I was attracted by the title "A Modern Zeno," and I was very much surprised to learn the identity of the man. Mr. Russell, the writer of the article, has evidently made some study of Non-Euclidean Geometry, especially of the writings of Lobatchevsky. But truly "a little learning is a dangerous thing." His study has been super-

ficial and without understanding. It is not my intention to criticise the article in detail, but to point out two errors that make it almost worthless.

On page 294, it is stated that the straight line containing the vertex of an isosceles right triangle and the midpoint of the hypotenuse divides the triangle into two equal isosceles right triangles. That these two triangles are equal right triangles is true in the geometry of Lobatchevsky, but that they are *isosceles* cannot be proved from his assumptions, although Mr. Russell says that the proof is so simple that it would be an imputation upon the reader to spread it before him.

On pages 300-302, Mr. Russell has given what he thinks is a proof that the geometry of Lobatchevsky is self-contradictory. His error is due to the fact that he used Theorem 25 without understanding it. It is true that he has stated it in the exact words of Halsted's translation of Lobatchevsky's *Researches on the Theory of Parallels,* namely "Two straight lines which are parallel to a third are parallel to each other"; but either he did not read the proof given there or he did not understand it. The theorem as stated is incorrect or perhaps I should say it is incomplete. But this fact would not have been misleading if he had read and understood the proof. On page 34 of H. P. Manning's *Non-Euclidean Geometry,* the theorem is more carefully stated as follows: "Two lines parallel to a third toward the same part of the third are parallel to each other." Indeed it is stated on page 13 of Halsted's translation that in the geometry of Lobatchevsky we must make a distinction of *sides in parallelism.* Mr. Russell's failure to take account of this distinction vitiates his argument. That he has utterly failed to comprehend the distinction is evidenced by the following statement taken from the bottom of page 302: "Now by the very same course of deduction (no step of which is unsanctioned in the 'system' of Lobatchevsky) the line KAK′ is shown parallel to HAH′ and to EAE′, in spite of the rather important fact that they cut one another at A."

It seems that Mr. Russell has some doubt as to the correctness of his conclusion, for on page 303 are these words: "Still it may be that there is something about the matter that I do not understand. If so, I can only protest that my failure is not due to any lack of respectful (I do not want to say absurdly respectful) study of Lobachevsky's little brochure." It looks to me as if Mr. Russell did want to say "absurdly respectful." My comment is this: Perhaps

it was respectful. Certainly it was superficial and without much comprehension, especially in connection with Theorem 25. The first of the two errors I have mentioned shows his lack of understanding of the details of Lobatchevsky's geometry, but it is not so serious because it led him merely to some remarks about a "bent plane." The second error is more serious because it led him to the conclusion that Lobatchevsky's geometry is self-contradictory and that "we find Lobatchevsky hitting upon the right and sufficient way of proving the parallel postulate of Euclid."

The Monist is devoted to the philosophy of science, and articles on Non-Euclidean Geometry are certainly not out of place in its pages. A good paper on the subject or its philosophic import may be written by one who is not an expert mathematician, but it seems to me that such a paper should be carefully read by an expert mathematician before publication, so that errors due to the author's lack of knowledge of the technique of the mathematics involved may be eliminated. Certainly this should be done when an author thinks he has found a fallacy in a doctrine accepted as sound by mathematicians the world over.

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PROFESSOR LOVEJOY ON "DER VORCHRISTLICHE JESUS."

The following reply to Professor Lovejoy's criticism was promised in a footnote for the January number of *The Monist* and was in fact written out in full nearly two weeks before October 29, 1908, when I sailed for Chile. But as the protracted absence from the United States that followed rendered it quite impossible either to give the paper final revision or for me to see the proofs, if it should be issued in January, it seemed best to hold it back for the present number. The occasion for any rejoinder whatever is supplied not by the argumentative appeal of the review, which may be safely left to the judgment of readers of the book, but by its strictures upon the author's treatment of authorities, especially of Hippolytus.

Imprimis, let me thank Professor Lovejoy for the general manner of his review. While not exposing fully the argumentative nerve of the work in hand, he seems really to have intended to get at the heart of the matter, and his statement of the main drift of the essays calls for acknowledgement. Moreover, he has not shrunk

from making certain concessions, which seem to be far-reaching, however restricted they may have been in the purpose of the reviewer.

I. It is particularly in dealing with Hippolytus that Professor Lovejoy's criticism calls for comment. He has, in fact, in terms doubtless meant to be as delicate as possible, charged upon me unfairness in citation. He quotes from p. 123 that Hippolytus "declares repeatedly that the Naassenes were the first of the heretical sects, from whom all the others afterwards known as Gnostics derived (*Ref.* V. 6, 10, 11)." "We may quite definitely conclude, therefore, in agreement with Hippolytus, that Naassenism was antecedent to Christianity, that it flourished before the Cross was preached, and that the later forms of Gnosticism were its offspring" (p. 124).

To these sentences, thinks Professor Lovejoy, the readers of Hippolytus will "revert with some astonishment." First, he denies that H. in the "passages cited makes any such statement as that ascribed to him, about the descent of all other Gnostic doctrines from Naassenism"; secondly, he declares that "H. in plain terms describes the Naassenes as Christians. They are classified as a "heresy"; they taught that the archetypal Man "descended in one man, Jesus, who was born of Mary" (V, 6); they traced their doctrine "through Mariamne to James, the brother of the Lord"—which, of course, shows them not only Christian but also, at earliest, of the first or second generation *after* the Apostles. Dr. Smith's omission to mention any of these statements of H., and his citing of that authority as a witness in favor of a view of the date of the Naassenes which the very same chapters of the *Refutatio* categorically contradict—this is a thing so amazing that it is difficult to comment upon it with propriety." In a word, the gravamen of his charge is that the author has suppressed statements of H. that show precisely the opposite of what the author ascribes to H.

Let us see. It may not be necessary to weary the reader with citation, but in any case the matter is too serious to pass over lightly.

Does H. declare repeatedly that the Naasseni were the first Gnostics? Book V of the *Refutatio* opens thus: "The following are the contents of the fifth book of the Refutation of all Heresies: What the assertions are of the Naasseni who style themselves Gnostics." It is not here said of the following Peratae, Sethians, Justinians, that they called themselves Gnostics, but only of the Naas-

seni. To my mind there is here a general identification of Naassenes and Gnostics, stated almost as clearly as Hippolytus states anything. Again H. proposes here (and the sentiment is repeated in VI, 6 and X, 9), "to begin from those that have dared to celebrate a serpent, the author of the error (*τὸν αἴτιον τῆς πλάνης γενόμενον ὄφιν ὑμνεῖν*) . . . . The priests then and champions of the system (*δόγματος*) have been *first* those surnamed Naasseni (*πρῶτοι οἱ ἐπικληθέντες Ναασσηνοί*), in the Hebrew tongue so named—for the serpent (*ὁ ὄφις*) is called *Naas.*" The decisive adjective *first* is seemingly unobserved by Professor Lovejoy,* who remarks queerly that the phrase "afterwards called themselves Gnostics" "does not imply that they were the only or the first heretics who did so." Apparently in eagerness to convict the author of misstatement, Professor Lovejoy seems to overlook logical pitfalls. If the Naassenes were not the first Gnostics, then the latter must be even older than the author maintains, which would strengthen the general position of his book perceptibly. These Naassenes who called themselves Gnostics were the *first* in championship of the dogma (Gnosticism). If this does not mean that they were the first Gnostics, what does it mean? And if they were not the first, who pray were the *first*? And who were the others, if they were not the only? H. continues: "Afterwards they surnamed themselves Gnostics, declaring they alone knew the depths." There is no hint that they took the name Gnostics from any others; they surnamed themselves so for a specific reason: they nicknamed themselves *Knowers,* because they *alone* did know. The only fair understanding of such words is that the surname Gnostics originated with these Naassenes; in the absence of any counter-indication, we must affirm as much. H. proceeds: "From whom many having parted off multifariously constituted the heresy, though essentially one, in different dogmas detailing the same things, as the discussion as it advances shall prove." From this passage, in connection with others similar, I have inferred that H. would represent the Naassenes, surnamed Gnostics, as the first Gnostics, from whom all other Gnostics sprung, the heresy having parted into many subdivisions. Is not the inference fair? Professor Lovejoy holds that it refers "merely to the diverse subdivisions of the Ophite Sect." But Ophite Sect means Ophites, and this is merely the Greek for Naassenes (*ὄφις = naas,* says H.), and this was the earlier name for such as "surnamed

* But not by Mansel, e. g., who repeatedly speaks of these sectaries as "first," "earliest Gnostics." "The Naassenes, the earliest sect according to the arrangement of H., are spoken of by him as the first body who assumed the name of Gnostics" (*Gnostic Heresies,* 7, 95, 104).

themselves Gnostics." That my interpretation was not forced, but perfectly natural, is made clear by the remark of Dr. Salmond in a footnote to his translation of H.: "γνῶσις,—a term often alluded to by St. John, and which gives its name "Gnosticism" to the various forms of the Ophitic heresy." The position of the great English scholar, who certainly has no bias in favor of *Der vorchristliche Jesus,* seems to agree precisely with the position which Professor Lovejoy so criticises—and yet seems to adopt as his own!

Further on (V, 8) H. designates these same Naassenes outright as "the Gnostics": "Following these and the like, the most marvelous Gnostics, inventors of a new grammatic art...."

Again, in quoting the Naassene Parable of the Sower: "That is, he says, none becomes a hearer of these mysteries except only the *gnostici perfecti* (οἱ γνωστικοὶ τέλειοι)."

Again, (V, 11): "These (the foregoing) doctrines, then, the Naasseni attempt to establish, naming themselves Gnostics. But since the error is many-headed and diversified, as in truth the hydra that history tells of, when at one blow, wielding the wand of truth, we have struck off the heads of this (heresy) by means of refutation, we shall exterminate the whole monster. For neither do *the remaining heresies* show off much different from this, being mutually connected in spirit of error. But since, altering the words and the names of the Serpent (ὄφεως), they wished there to be many heads of the Serpent, neither so shall we fail to refute them as they will." So closes H. his 38-page long treatment of the Naasseni. The extreme length of this treatment, greater than is given any other single heresy, shows clearly their decisive importance in his eyes. Playing on the terms Naas and Ophis, he likens this Naassenism (Ophism) to a Hydra, he seems to identify it with Gnosticism, he thinks that in beheading it he has beheaded all heresies, since the rest (αἱ λοιπαὶ) are held together (with it) in spirit of error; he does not regard *the rest* as really worth while; nevertheless (ἀλλ'), since they are heads of the same Serpent (that is, outgrowths of the same Naassenism—Ophism), he will smite them also one by one, and *this he straightway proceeds to do* in the remainder of his work. If not then quite as plain as day, it is at least as plain as anything in the *Refutatio,* that H. regards his task as in principle fulfilled with the slaughter of the Hydra or Serpent of Naassenism; but to make assurance double sure he will thrice slay the slain, he will smite to death through his following pages every form of the many-headed monster. The simile is faulty, but the meaning is clear.

Manifestly H. must and does regard these "remaining heresies" as second in importance and still more in time. The multifission of the Hydra must follow and could not precede the Hydra itself. It is evident beyond argument that H. regards these "other heresies" as later and as offshoots of primitive Naassenism. He does not indeed say "all other heresies," but he does say "the remaining heresies." The meaning is the same. H. is speaking of a class of things, and a single class, and the "all" was not necessary. He was not careful to guard against quibbling that he could not anticipate. This use of the article in a universal sense is regular in Greek. Euclid does not say "All parallelograms on equal bases and between the same parallels are equal to one another" but "*the* parallelograms" (*τὰ παραλληλόγραμμα*); so in the famous 47th it is not "in *all*" but "In the right-angled triangles" (*ἐν τοῖς ὀρθ. τριγ.*) The case is not different in English; says the master logician, W. Stanley Jevons (*Elementary Lessons in Logic,* p. 65) "I shall frequently use propositions in the indefinite form as examples, on the understanding that where no sign of quantity appears, the universal quantity is to be assumed. It is probable that wherever a term is used alone, it ought to be interpreted as meaning the whole of its class." Such is plainly the necessary interpretation here; for if not all forms of Gnosticism be derived from this primitive (in H's estimation), then he must have supposed some other independent primitive. But is there the slightest shred of evidence that he ever assumed two original sources of Gnosticism? Or that there ever was any other than the one Ophitic source? *Entia non multiplicanda sunt praeter necessitatem.* This razor of Occam shears off any other stem until its necessity is proved, and no proof has ever been attempted. What form of Gnosticism was there that could not be traced back to Naassenism, in H's conception? What Dr. Salmond thought of the matter appears clearly in the heading he has given to this chapter VI: "The Ophites the Grand Source of Heresy," and again to chapter I, Book VI: "The Ophites the Progenitors of Subsequent Heresies."

I should here remark that in my original thought only the first part of Professor Lovejoy's quotation, was intended as a declaration of H., "That the Naassenes were the first of the heretical sects"; the following clause, "from whom etc. derived," was intended merely as my own inference gathering up the diffuse and disconnected deliverances of H. into a single statement. The reader now has the facts sufficiently presented, and in view of them I maintain with added emphasis that the natural and hardly avoidable inference from

the words of H. is that he regarded all "the other heresies" or forms of Gnosticism as diversifications of primitive Naassenism. Possibly the language of the text may sound a little dogmatic, but the explanation is easy to find, by glancing at the opposite page, 122, where it is stated that unfortunately it was not possible to go into details at that point, but that only the general lines of the argument could be laid down. In fact, the detailed treatment of the *whole* testimony of H. has for some years lain in my desk in manuscript, waiting upon a similar treatment of Irenæus, not yet completed, the two to be published together. Pages 122-4 merely resumed under heads A, B, C, D in briefest terms some main results of that study. But even as it stands there is naught to retract. The statement of the text is borne out by comparison of all the pertinent passages in H.

Of itself the criticism of Professor Lovejoy may not seem to call for so much attention; but it may be properly used as an occasion to set an important matter in clearer relief.

However, it is not this quotation that most moves the amazement of Professor Lovejoy, not to say his virtuous indignation. It is the alleged suppression of the alleged counter-testimony of H., that the Naassenes were at the earliest post-apostolic. Now if the pages in question had professed to give full discussion of the matter, this "omission" might justly have excited more than marvel. In fact, however, they profess no such thing; they give intentionally *no discussion at all* but merely state certain results to which the writer had been led by a minute study, yet unpublished. Now these results were *all* that the pages professed to state; the minute investigation is a large part of a volume yet in manuscript. In that volume the reader will find a discussion of the passages referred to by Professor Lovejoy—a discussion almost painfully minute. The *results* stated on page 123 are not in the least affected by the passages in question. They hold firmly in spite of those passages. Such being the case, I felt and still feel myself justified in stating the results arrived at, without any mention of passages that do not really invalidate those results. In such a summary statement of conclusions it would be out of place to refer to objections that do not really hold. Their "omission" does not imply that such objections can not be made, but only that in the opinion of the writer they can be satisfactorily answered. In the present case the passages were not quoted, because they appeared trivial. My critic may hold that so far from being trivial they are weighty and even decisive. The reader may judge. Professor Lovejoy says: "H. in plain terms

describes the Naassenes as Christians." He does indeed quote a Naassene writer as saying: "And of all men we Christians alone are those who in the third gate celebrate the mystery etc." (V, 9). But what of it? *When* the Naassenes assumed this name is not said, not hinted, neither do we know how old is the name itself. It may very well be pre-Christian. There is in fact a double reference in the word Christian, to which I had never supposed it would be necessary to advert, namely a chronological and a dogmatic reference. Chronologically Christian refers definitely to the year 1 of our era and later; before the beginning of that year, everything was pre-Christian. Dogmatically it refers to the general thought-content of the propaganda that has spread over Europe and America. This Christian content, I contend, was in large measure pre-Christian in time. The Naassenes might have called themselves Christians before A. D. 1, though I by no means affirm that they did so "Christians" (i. e., Christ-servants) may have been one of their later names.

Professor Lovejoy continues: "They are classified as a 'heresy.'" This has no significance, no evidential value. "Heresy" simply meant sect, school, set of philosophic or religious principles, and there is no reason for supposing that heterodoxy must be later than orthodoxy. In my judgment the heresies were not in general deviations from existent orthodoxy; on the contrary, they were *more ancient* forms of faith, which orthodoxy had outgrown and left behind; just as errors in syntax and pronunciation are very often only elder correct forms of speech, which the language has at last rejected.

Professor Lovejoy again: "They traced their doctrine "through Mariamne to James, the brother of the Lord"—which of course, shows them not only Christian but also at earliest of the first or second generation *after* the Apostles." "H. plainly and consistently describes them as a late first-century or second-century school." Indeed! So then they were at earliest near the beginning of the second century! It is hard not to smile at the naïveté of these deliverances. Of Mariamne we know little or nought. Origen indeed speaks of the followers of this shadowy character as mentioned by Celsus, but himself had met none of them (C. C. V. 62). But "James, the brother of the Lord"! Here Professor Lovejoy assumes the whole point in controversy. If James was really the flesh-and-blood "brother of the Lord" (i. e., of Jesus), then the book reviewed was not worth reviewing. But can it be that any one really attaches

weight to this expression, even when strengthened by the prefix "twin"? Least of all men does Professor Lovejoy need to be taught about kinship in the Orient. Who can forget the answer of this same "Jesus" to the question "Who are my brethren"? How "looking round on them which sat round about him, he saith, Behold, my mother and my brethren! For whosoever shall do the will of God, the same is my brother, and sister, and mother." It would be hard to imagine a passage more thoroughly in accord with the contentions of the work reviewed. In Matt. xxviii. 10 the same Jesus says "Fear not; go, announce to my brothers." And in John xx. 17 "Go to my brothers and say to them," clearly meaning disciples. Jerome understood the matter better, for he says, commenting on Gal. i. 19, "James was called the brother of the Lord because of his great character, his incomparable faith, and his extraordinary wisdom." The Epistle attributed to James shows not the faintest trace of blood kinship with Jesus, in fact *nowhere suggests the New Testament story,* but expounds solely the philosophical morality of the Dispersion. As well might one think of Epictetus or Marcus Aurelius as of its author as consanguineous with Jesus. The phrase "Brothers of the Lord" seems to be merely one of a score of names borne by groups of early propagandists. As such a class name it appears in 1 Cor. ix. 5, "The Apostles and the Brethren of the Lord and Kephas." We need not then "strike out" anything "from Hippolytus's text"; these "numerous passages" are not "unfavorable to the theory of a pre-Christian Jesus." But even if they were, what would it signify? Simply that H. himself did not embrace that theory, that he occupied the modern standpoint of Professor Lovejoy. And doubtless he did. Like Epiphanius and all the heresiographers he was an Old Catholic and held fast to the view established against the "heretics" in the second century and prevalent to-day. Even had he explicitly declared the Naassenes were post-Christian in origin, it would not matter; for he would merely have been expressing what *must* have been his faith, whether with or without evidence, whether consistent or inconsistent with acknowledged facts. The truth is, all the heresiologues are special pleaders. They *had* to make out a certain case against the "heresies"; they *had to post-date* them, in order to uphold their dogmas. It made no difference that unmanageable facts embarrassed their faith; the more intractable the fact, the more steadfast their faith; with Tertullian they cried out, "I believe it, because it is impossible." Hence the deliberate statements of these excellent men regarding heresiarchs and

their dates count but for very little, being divided by such a large factor of prejudice. All the more heavy do their unthoughted statements fall into the scale. Their unmeditated words are also unmedicated. It is these we are to heed most closely, from these we must draw out the implications of which the authors were unconscious. It was Thenius (I believe) who shrewdly said of a datum given by Josephus: "This statement appears to have been made incautiously; we may therefore accept it as correct." Professor Lovejoy smiles at "the humorous idea of a conspiracy of silence about the Nasaraioi"; but why should such a conspiracy be more unlikely in the third century than in the twentieth? It would imply only a general motive operating on the writers: a bewilderment as to how to deal with these ancients,—a bewilderment manifest enough among moderns also.

Now let us see how the whole representation of H. impresses a competent English specialist certainly orthodox enough to please Professor Lovejoy. Speaking of Hippolytus on Justinus, Dr. Salmond says: "What H. here states respecting Justinus is quite new. No mention occurs of this heretic in ecclesiastical history. It is evident, however, that, like Simon Magus, he was contemporary with St. Peter and St. Paul [an *elder* contemporary according to Acts viii. 9,—W. B. S.] Justinus, however, and the Ophitic sect to which he belonged, are assigned by H. and Irenæus a prior position as regards the order of their appearance to the system of Simon, or its offshoot Valentinianism. The Ophites engrafted Phrygian Judaism, and the Valentinians Gentilism, upon Christianity; the former not rejecting the speculations and mysteries of Asiatic paganism, and the latter availing themselves of the cabbalistic corruptions of Judaism. The Judaistic element soon became prominent in successive phases of Valentinianism, which produced a fusion of the sects of the old Gnostics and of Simon. Hippolytus, however, now places the Ophitic sect before us prior to its amalgamation with Valentinianism. Here, for the first time, we have an authentic delineation of the primitive Ophites. This is of great value." We need not accept all that Dr. Salmond here says. Some of his constructions may be faulty; the important fact is that he states unequivocally that Justinus was contemporary with St. Peter and St. Paul, and that Hippolytus and Irenæus assign him a "position prior to the system of Simon," himself prior to the preaching of Peter (Acts viii. 9). Here then Dr. Salmond ranges himself squarely against Professor L. in the matter under debate. What Dr. Salmond

neglects to state is that H. writing of Justinus declares that "all these style themselves Gnostics in the peculiar sense that they alone have drunk down the marvelous Gnosis of the Perfect and the Good." Here then was a Gnostic *prior* (according to H.) to Simon Magus (who was *at the latest* contemporary with Sts. Peter and Paul), hence in the first half of the first century; moreover he was an Ophite, a Gnostic, full-fledged. Moreover he is placed by this same H. after the Sethians, and these after the Peratae, and all these after the Naassenes, the Ophites proper, the first who surnamed themselves *Gnostics.* These latter facts are no less important, indeed far more important, than the ones that Dr. Salmond emphasizes, which by themselves are enough to upset Professor Lovejoy's contention completely.

If then I am at all capable of comprehending chronological combinations, I must hold unshaken the positions of *Der vorchristliche Jesus* with regard to H. It should be added that the chronological order given by H. is fully confirmed by analysis of the various doctrines, that of the Naasseni showing itself to be obviously the most primitive. No one, however, would insist upon the particular order of the middle terms, Peratae, Sethians, Justinians, who may well have been nearly contemporary.

II. With regard to the testimony of Epiphanius it seems sufficient merely to refer to the passages quoted in full in *Der vorchristliche Jesus,* as a correction of the representations of the review. The reader may judge for himself. So far as the general opinion of reviews would seem to go, there is but one escape from the conclusions of the text: to deny outright that Epiphanius knew what he was talking about. The desperation of this last resort needs no comment.

III. With regard to ἀνίστημι and ἀνάστασις Professor Lovejoy is at pains to show that the former is used classically to mean "restore to life."

> "Thou say'st an undisputed thing
> In such a solemn way."

The same is distinctly recognized in *Der vorchristliche Jesus.* The passages referred to by Professor Lovejoy (I. 24, 550-551), Agam. 1361, Electra, 139) were not mentioned, nor Eur. H. F. 719, more apposite though uncited by Steph. or L. and S., because the discussion was not about ἀνίστημι but about ἀνάστασις. It was not questioned that "raise up" might be applied to the dead, indeed such an occasional use seems almost inevitable; not quite so, however,

the use of "raising up" as the technical term for resurrection from the dead, though this sense was also admitted as "perhaps known from the earliest times." In fact the actuality of the double use was well-nigh essential to the argument of the text. The verses, Is. xxvi. 14 and Job. xiv. 12, mentioned "as pertinent passages our author likewise neglects to quote," are caught by Professor Lovejoy in a net as fine-meshed as a Pasteur filter. "Dead, they shall not live; shades, they shall not rise" (Is. xxvi. 14): "So man lieth down and riseth not" (Job xiv. 12). Such a use of the Kal future of *qûm* in the commonest sense of *rise up* was surely not under consideration. That the rising is from the couch of death, is given only by the context. The passages have no logical pertinence. If such must be cited, what can be omitted?

Professor Lovejoy thinks the linguistic argument wholly without valuable results, in striking contrast with a pre-eminent Biblical scholar in England, who declares that "though exceptions may be taken to some details of the argument, a *prima facie* case is certainly made out." Perhaps it may be well to recall the logical movement, which can hardly be detected in Professor Lovejoy's comments. The reader will find the situation summed up on pp. 81-82: The preachers in Acts use uniformly terms that might indeed mean resurrection (from the dead), but to their hearers at least meant much more naturally and familiarly quite another thing, namely, establishment. They spoke in the same breath of "raising up David" and "raising up Jesus." It would be strange if under the supposed conditions they indulged in an unnecessary pun. They also certainly spoke of this "raising up of Jesus" (Acts iii. 22, 26; xiii. 33) in the sense of establishment; strange that they should also use it then originally in a sense entirely different. Also the text criticism shows that the phrase "from the dead" is in many cases loose and uncertain and bears strong internal marks of being an insertion.— But this linguistic argument does not stand alone. It is confirmed by the second half of the essay, which even critics who reject the first half find very significant. The argument must be judged as a unit. In fact, the whole argument of the book is cumulative. It must be answered, if at all, in its entirety, not merely in this or that detail.

IV. The case of Apollos has proved a veritable *crux* to the critics of *Der vorchristliche Jesus*. Nearly every one adventures a solution of the difficulty, no two the same solution, and no solution at all acceptable. Loisy, in reviewing *Der vorchristliche Jesus*,

concedes the inadequacy of all solutions and admits (*il faut admettre*) that the primitive preaching must have taken place under forms more various and conditions more complicated than hitherto supposed. This concession seems to me to go very far, much beyond what Loisy intended. Clemen takes the bull by the horns, frankly declaring that the author of Acts must have erred. Soltau admits that the reference in τὰ περὶ τοῦ Ἰησοῦ must be to the *cult* (*Religionsanschauung*) and not to the historic content of the life of Jesus Into this list of warring explanations Professor Lovejoy's may enter with the rest. To my mind it goes far aside into irrelevant matters, leaving the knot of the difficulty untouched. It is at best what a chemist might call a 2% solution.

In conclusion, let me reiterate that the argument of the book cannot be judged save by the laws of cumulative evidence. It is the *whole* body of facts adduced that must be adjusted into some self-consistent scheme of interpretation. We must restore in thought the unity and coherence that undoubtedly bound them together originally. Nor let any one imagine, as does Professor Lovejoy apparently, that practically the whole body of evidence thus far accumulated or at least the most important elements have been presented in *Der vorchristliche Jesus*. That work was in fact a reconnoissance in force. The mass of evidential matter already gathered is three or four times as great and in my judgment has independently even greater demonstrative power. Of course, the examination is not yet complete; in the nature of the case it cannot be completed, but it seems to have gone far enough even now to indicate clearly that (to quote a distinguished British scholar and philosopher) this new "conception of the *Origines* of Christianity is in the main on right lines."

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THE FUTURE OF ARTIFICIAL LANGUAGES.

I am somewhat at a loss to understand why any Monist does not readily grasp the idea of an auxiliary international language, for I read:

"Monism is a unitary conception of the world. The world must be conceived as one inseparable and indivisible entirety. It admits of a constantly increasing realization and of a future perfection. The monistic idea of a unitary conception of the world

has been constantly corroborated by the progress of science," etc.—*Primer of Philosophy,* pp. 4-5.

But I take take it that the able advocate of monism has no quarrel with the adoption of some "natural" language, preferably English, as an international medium, but rather questions the necessity or feasibility of an artificial language and prefers the more comfortable rôle of a spectator merely.

Let us first examine such claims for the English for a brief space and see where we may arrive, prefacing my remarks with the assertion, that, personally, I would look upon the universal adoption of any existing language as almost in the nature of a calamity, while admitting the progress English has been making.

Not touching here upon its irregularities or whether the Mohammedans can ever be induced or compelled to accept it, the illogicisms of our really great mother tongue are almost intolerable to any one aiming at clarity of thought. For example, we say "the sun is rising" or "is setting" when it is the motion of our own planet that has deceived our senses. We say "I am disgusted with" when we really mean at, or from, or against, and a very recent account in a local paper describes the distressing accident to a Scandinavian carpenter working in the lower story of a mill under construction. When he heard the cry "Look out!" of some men canting a log above, the unfortunate man literally obeyed by thrusting his head out of a window, and as a result was practically decapitated. But why continue, for I know that French and assume that every other existing tongue, have such, or greater crudities, yet none such could be tolerated in any well-constructed artificial language, for example, like "Ilo" (the latest evolution of Esperanto, as simplified and reformed), and a greater familiarity with either of these systems must explain any preference for exemplifying them herein.

Again, how many words we often have to use for expressing a simple idea when one appropriate word should suffice, as *penvalorar,* "to be worth the pains." When the child was asked "Have you a good memory?" and he truthfully and logically answered "No, but I have a bad *forgetency,*" he was considered both amusing and original, yet I have often thought that if we could have a competent and authoritative academy (as indeed most artificial languages have) for our own tongue, it might possibly be able to do something in the way of correcting our illogicisms, modify many of our irregularities and improve our phonology; but I fear this would be expecting altogether too much, as most living or natural lan-

guages become too stereotyped and there is generally much prejudice against all innovation.

Such an academy might also by precedent sanction such words as "criticable," "makeable," "hopeably," "fixable," "elsewhen" (elsewhere), "farness" (nearness), "outgo" (income), "beginningless" (endless) and many other apparently strange but useful forms, but the idea perhaps is utopian. Yet the man in the street readily assimilates such neologisms as "plunderbund," "talkfest," "brainstorm" and the like, for he is above all things a practical fellow who never mistakes a bathsponge for a spongebath, a houseboat for a boathouse or a billboard for a boardbill!

Now, in Ilo and Esperanto we have all such ideas as the foregoing, with a very great number more, neatly and accurately expressed, at least in the first named system, for it has borrowed the conveniences of six of the greatest living languages—German, English, French, Italian, Russian and Spanish, (the DEFIRS which its dictionary appends to a root), while ignoring their shortcomings.

Thus (and this I consider to be almost the crux of the whole question, the very marrow in our bone of amicable contention), on the basis of "the maximum of internationality," the Ilists select a "root" that is common to the greatest numbers of millions, when they can, by "word-building" with one or two of the well-defined affixes or "exponents," carry it to its fifth, tenth and even twentieth "power," each expressing a different shade of meaning and without materially increasing the root's length. I ask, can the same be done with any word in English, or any other known tongue?

Let us take the international √ *futur-* which can also be found in such non-Romanic tongues as German and Russian, and we build *futuro,* the noun; *futura,* the adjective; and *future,* the adverb "futurely," which last form the English lacks, while the same form must serve for both its noun and adjective.

Again, touching now upon the feature of brevity with clarity, take the lengthy name *U*nited *S*tates *o*f (*N*orth) *A*merica, and *Usono* is understood by Esperantists and Ilists alike, while *usonano* gives us the inhabitant or citizen thereof exactly, instead of the altogether too generic term "American," who may really be a native of Canada or any of the South American republics. So Ilo is a contraction of *i*nternaciona *l*ingu*o* and happens to mean, appropriately enough, an "instrument," with many derivatives therefrom. But this method of monogramic abbreviation is used sparingly.

Now, without going into the defect of our many homonyms

like peace and piece, pain and pane, a defect also common to other natural languages and which is of course eliminated from an artificial one, much as artificial teeth successfully replace bad natural ones, let us here state a few postulates now generally accepted by all students of this latest branch of philology, the artificial—of which Dr. L. Couturat and his confrere, Dr. Leau, are undoubtedly the greatest living authorities and historians, and to whom, with de Beaufront, "the father of Esperanto in France," we are largely indebted for the later product, Ilo. Philologists now generally concede:

1. That all artificial languages are secondary to, and are never intended to supersede the mother tongue.
2. That the primary use of any artificial language is for commerce, science and travel and that it is as yet premature to attempt any literary efforts or translations (although I am aware the Esperantists have disregarded this rule).
3. That such artificial language should be founded on an *a posteriori* basis and not an *a priori* one (i. e., we should draw material from existing languages rather than coin previously unheard-of words, like those composing Zamenhof's correlative table).
4. That a good artificial language, constructed with the "maximum of internationality," can be learned with advantage by young and old, as laying a foundation and easy entrance to many other languages, living or dead.
5. That the analytic is preferable to the agglutinative form.

To these postulates I should add the formula found by that clear-thinking Dane and great philologist, Prof. Otto Jespersen, who has since laid down the axiom (the original is easily read): "La max bona linguo internationa esas ta, qua prizentas la max granda facileso por la max multa homi," and, anticipating the inquiry, will state that the foregoing is in neither Latin nor Danish, Italian nor Spanish, nor yet Esperanto.

Religion is much akin and only comes secondary to language, and who has counted the number of systems of the former that have been *created* and flourished? And naturally any such *bela ideo* as Esperanto, like a religion, attracts many idealists and possibly a few intolerant or mediumly-educated people, mostly monoglots with a growing knowledge of their idol, for which they too often make the most extravagant and preposterous claims.

Yet there are many notable exceptions, like the veteran Richard

H. Geoghegan of Fairbanks, Alaska. Only a few of his intimate correspondents know of the profound learning and very great linguistic attainments of this modest and versatile man, with whom it seems to be a recreation to study another language about every three months and who has done an immense amount of correspondence in Esperanto since 1889, with Jón Jónson of Iceland, M. Bourdalue of New Caledonia and with many others as widely distributed, all tending to show how much can be done with an international language and that the idea is becoming a practical reality.

I cannot agree with Dr. Carus that "irregularities originate according to our needs"; rather do they grow according to our elemental minds or our slovenly habit of thought. Granted that "artificial languages would soon introduce certain irregularities," yet they would only be local or at most national departures from the standard of purity and excellence laid down by their Academy or Fundamento (which latter is like the Koran to the Arabic).

True, as Dr. Carus intimates, we may not have attained the ultimate, for if we had, we would at once commence to retrograde and decay; our product is "not perfect, but always perfectible." But the Delegation which met at Paris in October, 1907, for the adoption of some international language, laid a very solid foundation when, of the many systems presented, it accepted Dr. Zamenhof's creation, but subject to the modifications proposed by de Beaufront, Couturat, Jespersen and others, and which have since been incorporated and appear in its organ *Progreso*.

Possibly some great Oriental linguist, as yet unborn or now in the infantile dairy business, may some later day arise in his might and smite us on the ground that Ilo is altogether too European, but are we meantime to stand idle in the event of such a remote contingency? That would certainly not be progress, and he would surely be welcome to the laborious task of building an Asiatic rival, with Arabic-Hindustani-Chinese roots.

I can barely touch upon the inestimable scientific value of an international language, with a terminology constructed by specialists and acceptable to all scientists, nor what an instrument it will be as making for peace and righteousness. As I look across my desk I see several pigeonholes containing letters from various parts of the world, written clearly and concisely in an apparently strange idiom, yet one that seems far more flexible than my own great tongue, as euphonious as Spanish or Italian, phonetic, legible and brief; and I venture to assert that not one of your readers, be he of

English, French, Spanish or Italian extraction, will fail to almost instantly understand the following short specimen:

"La establiso di la internaciona linguo tute ne esas verko di personala inspireso, fantazio od arbitrio, sed verko di cienco e di pacienteso. Ni ne pretendas a neeroriveso e ne konsideras nia verko quale ideala. Ol esas simple verko di cienco, di koncienco e di bonvolo. Nia verko ne esas certe perfekta; sed, quo forsan plu valoras, ol esas sempre perfektigebla."

In conclusion I must agree with Dr. Carus that the Esperantists at least have perhaps been far too hasty and over-anxious, and I must plead guilty as having been one of them. Certainly many of them have shown an unreasoning antagonism to even the most essential changes and reforms. When the Doctor suggested a system of pasigraphy some years ago, he did not attempt to force its acceptance, assert that it was "untouchable" or make any extraordinary claims for it. Nor yet, on the other hand, did he then raise any question as to its cerebral receptivity or acceptance through the optic instead of the auditory nerve! But why did he not suggest an already existing pasigraphy like the Chinese? And the anticipated answer that it is too cumbersome and unsuitable for international usage will also apply, with but slightly lesser force, to English or any other naturally evolved language.

And finally I ought not perhaps to forget a word of commendation for Mr. Strauss's able and impartial argument, not forgetting to add, however, that M. Bollack has since given up any attempt to propagate his own system and thrown his forces with the Ilists.

ALEXANDER H. MACKINNON

SEATTLE, WASH.

A DEFENCE OF INTERNATIONAL LANGUAGE.

In the October issue of your magazine you propose to have the problem of an artificial language discussed, and you proceed to express yourself adversely, while Mr. C. T. Strauss defends it, though, according to his own admission, rather from the point of view of a theoretical observer than as a practical adept of one of the many international language systems. Permit me to answer some of your criticisms, and to supplement the remarks of Mr. Strauss by some observations gathered from two years' study and practical use of Esperanto, both in its primitive and in its new and simplified form ("International Language of the Delegation," "Ido" or "Ilo").

You consider more or less complete reforms in spelling and even in pronunciation as much easier to introduce than an artificial auxiliary language. You are willing to give the artificial language makers and adepts a chance to show what they can accomplish, but you believe that the life-time of one generation will not suffice to realize the problem. The friends of the artificial language idea are of the opposite opinion: they favor an artificial language because they think that it could be introduced within fifteen or twenty years, while fifty years would hardly be enough to make the Anglo-Saxon public of the old and new worlds accept even so comparatively slight shortcuts in their orthography as *ar, det, dum, fisic.*

Your criticism seems founded, in part, on the high office you attribute to such a language. Simplicity, indeed, cannot be a leading feature of a tongue that is to be adapted at a time to commercial relations, scientific communications, and literature in all its phases. This just objection cannot be too energetically repeated to the Esperanto fanatics who, with their leader Zamenhof at the head, insist upon squeezing works like "Iphigenie" of Goethe into the Procrustean bed of their 1000-root language (for the other 4000 or 5000 roots in Esperanto translate purely technical expressions).

You find that irregularities would result from an introduction of the language into the living practice, as the public would soon begin to contract inconveniently long forms. This consideration can only stimulate the makers of artificial languages to give their output a high degree of brevity and simplicity from the outset. The remodeling to which the Parisian committee subjected Primitive Esperanto in October of last year has been largely necessitated by a series of *a priori* forms, chosen arbitrarily by the inventor, and which have proven themselves a hindrance in the practice. At the same time, the principle was laid down that no artificial language can claim an absolute intangibility as to some of its parts, such as was proclaimed by the Esperantists in 1905, chiefly at the behest of commercial propagandists. A competent authority must be entrusted with the right to introduce further improvements, both additions and simplifications, and to guide the blind usage, which has during the last few years engendered in Esperanto a large number of anomalies. Your remark that irregularities in a language spring from abbreviations of speech, while it is correct to a certain extent, does certainly not apply to all cases. The forms *spring, sprang, sprung,* for instance, which in German grammar are called strong, i. e., regular verbs forming a class of their own, are in English grammar ordi-

narily classified as irregular; and this classification can be justified when bearing in mind that there is hardly one verb of this type to a hundred verbs of the type *jump, jumped, jumped.* This latter type has now become practically the norm and is still absorbing gradually verbs of older formation. The Academy of the International Language can prevent such apparent anomalies by foreseeing how unwise it would be to use variation of a median sound in a verb as a means of distinguishing tenses; for the unnecessary restriction in the choice of roots which would follow from the adoption of this plan would soon lead in practice to the parallel of a second and less cumbersome form. A well-formed artificial language will degenerate much less through usage than a national language, and the cases where difficulties occur will have to be handled on their merits by a competent body.

You suggest that the reformers should improve one of the existing languages, instead of making a new one. Here you have by independent reflection arrived at a conclusion which the Esperantists (at least those that are honest with themselves and others) have learned through practice. *A priori* language making has now been discarded to such an extent that even the free selection made by Dr. Zamenhof of many German or Slavonic roots (for instance *vosto* "tail," should be *kaudo* which occurs as a root or as a word in English, French, Italian and Spanish; *tago* "day," should be *dio* E. I. S.; *taugi* "to fit," should be *konvenar* E. F. I. S.; *varbi* "to recruit," should be *rekrutar* German, E. F. I. Russian, S.) has been absolutely rejected. The international vocabulary must be the easiest possible for the greatest number of men, hence a root known to 180 million people is to be preferred systematically to one known by 100 million.

The next requirement is that these roots must be capable of developing the needed derivatives according to a uniform system. Here again is a principle which is found in germ in Primitive Esperanto, but is recognized to its full extent only in Ido. Several suffixes have been added; the more or less confused use of the old ones has been regulated; a number of faulty derivatives or of awkwardly lengthy forms have been replaced by new roots of international character. In your former article, of October 1907, you very justly pointed out the dangers that could ensue from a dilettantic handling of the word-building material contained in Esperanto. Now precise rules for derivation have been laid down in the grammars, so that competent persons are able to form correct and clear derivatives in those cases where the amplified vocabulary does

not furnish simple roots. Persons of a less logical turn of mind are referred to the dictionaries, manuals or usage for acquiring their vocabulary. No language, whether artificial or natural, can do more; but to invite writers to form such expressions themselves, according to their best ability and without fixed principles, such as Primitive Esperanto has done heretofore, is to bring sure complication and ruin on the language.

Is it possible, then, with these great guiding principles of internationality and logical construction, to form a language that is above attack in all details? Perhaps not: ordinary common sense, rather than science, will, after all, have a small share in the fixing of the alphabet and of the grammar. Here simplicity must govern, and there may be some difference of opinion as to what is absolutely required and what not. Still, the most recent language projects do not differ widely on these points; so it seems the rejection of unnecessary complications cannot be carried much further. There must be no letters that are not in the Roman alphabet; there must be no sounds that would be difficult to several important nations; there must be no difficult combinations of sounds; there must even be euphony; and the grammar must be rather on the English type with logical word order, without an accusative and without an inflected adjective, than on the German type, with cumbersome declensions and syntax. It will be found especially difficult to choose the pronouns so as to please everybody.

Still, these minor points cannot be regarded as serious obstacles to the scientific, rather than the empiric solution of the problem. Jespersen has now given up entirely the Platonic attitude that you ascribe to him about the subject, and has treated on the above outlined topics in articles written in Ido itself, which have been published during several months in our monthly *Progreso*. He has also written the preface for the Ido-national dictionaries. Bollack, whose system Mr. Strauss is inclined to prefer, has laid aside his own work and is now with characteristic enthusiasm and generosity propagating Ido. He is, indeed, almost the only one of the inventors who has shown this latitude of spirit. For instance, Molenaar protests vehemently against Ido and continues to expound the advantages of his pan-romanic "Universal," which consists exclusively of ready made words adopted as they stand, is quite irregular in its vocabulary for any one who does not know a Romance language beforehand, and is dependent in all its details upon constant borrowing from living languages. Another group of language makers is now

perfecting the "Idiom Neutral" with the aim to produce a language that excels less for European internationality, systematic rules for derivation and extreme simplicity of grammar, than for its aspect of a living Romance tongue—as if a philologically revised New-Latin were not still far too complicated and idiomatic for general use! Aside from these systems on European and on Romance bases, there is at least one project based on the pure Teutonic and even one based on the Greek vocabulary.

On the other hand, many Esperantists, with their leader Zamenhof at the head, claim that science has nothing whatever to do with the problem, which according to them is a purely dynamic one: the language that is most thoroughly advertised and consequently attracts the most attention among the general public, has the best chances for success. This is true to quite a large extent, but still not so exclusively as the ordinary run of commercial propagandists of Esperanto believe. It would rather seem that an enthusiastic propaganda is possible only where the conviction as to the intrinsic merits of the propagated language is genuine. The rapid falling off in the number of adherents of Primitive Esperanto during the last four months, especially in Germany, is ample proof of this fact. The attempts of the Esperantists to make an impression by their noisy yearly congresses promise little for the future, since the city of Dresden became one of the centers of the Ido movement, just one month after seeing the enthusiastic gathering of the orthodox Esperantists last August.

Considering the mental capacity of its adherents, Ido seems now to have a fair lead over the competing systems. It is the aim of the movement to persuade inventors of other systems, as well as men of science who are interested, to take a seat in their planned academy and thus profit by their labors in further developing the language according to the established principles. It is not unlikely therefore that the preponderance of Ido will soon become overwhelming and that the followers of Zamenhof will have to make peace with the new system as best they can. While unity among the advocates of the international language idea seems still far off, the prospects are not discouraging. Granting that many details in Ido, especially those that relate to phraseology, are still to be settled more definitely, why should it not be possible in time to have the Ido academy replaced by an international commission, appointed by the different governments? And why should not the governments then recommend and even require a knowledge of the international language for certain

purposes? The impetus thus given to this language would soon be a powerful incentive for the general public to acquire a knowledge of it. I cannot possibly see why an international idiom thus acquired should, for the person using it, differ from any natural foreign speech that he has learned, except in this that the artificial language requires as many months as the other requires years to acquire. I can, from my own experience, testify that I learned to use Esperanto in conversation with what I consider a high degree of ease and fluency within five months, more so in fact than I succeeded with the English language within the same number of years, although, as a born German, I am by no means raw in languages, in fact have a fair degree of fluency in the oral use of four of them and a reading and theoretical knowledge of a number of roots.

The international language is certainly much more artificial than even literary German, but still it seems to me to be less artificial in its application to modern topics than classical Latin would be. It is and will be, according to the express declaration of its promulgators, "never perfect, but always perfectible." It should not be expected to compete with our national languages in wealth, for then it could no longer be simple; but on the other hand it aspires to a high degree of preciseness. As Ido has over Esperanto the great advantage of legibility at first sight, and over the other systems that of a vigorous propaganda, it takes no great gift of prophecy to foretell that it will spread enormously within a few years. It will be highly interesting to observe to what extent the practical application of this language in many provinces will refute the *a priori* objections of the majority of the scientists.

O. H. Mayer.

Chicago, Illinois.

ESPERANTO, ILO AND MALAY.

Concerning the establishment of an international language, we have so far preserved a neutral attitude, because we bear in mind that a language is comparable to living organisms, and it would be as easy to construct an ideal plant as to produce an ideal language. Languages grow just as plants and animals. A language does not consist merely of words that are printed in dictionaries, but exists in the living brain-structure of the people who speak it. I do not argue against the theoretical possibility of constructing an ideal plant or an ideal animal, or even a homunculus after the fashion

suggested by Goethe in the second part of Faust, but practically I deem such undertakings as Utopian, and it will always be easier to modify existing organisms than to construct new ones. All artificial languages have so far shared the same fate of being at the beginning enthusiastically hailed by a number of adherents, but when the attempt was made to have them spoken, the difficulty began. Those who speak the language soon disagree and without any effort of outside circles the two or several parties of its adherents disintegrate the movement and very soon it dies a natural death. Such was the case of Volapük, which created an enormous sensation at the time when it first made its appearance, but when it reached the height of its fame a strong reform party proposed improvements which were met with the bitter resistance of the founder and his immediate friends.

The same fate seems to repeat itself with Esperanto. We cannot judge whether the reformers who propose a language called Ido, or the original Esperantists are to be favored, but will only present the facts of both sides. In a recent report of the Fourth International Congress of Esperantists, in the middle of August, 1908, the following statement by Herr von Frenckell was read:

"Die Esperantisten wissen, dass sie uneigennützig ihre Arbeit der ganzen Menschheit zum Wohle stellen, und sie ertragen deshalb ruhig die immer noch recht häufigen Einwendungen der Zweifler an ihrer Sache. So konnte der Kongress auch einmütig sich gegen alle Veränderungen in der Sprache aussprechen und eine Akademie für die einheitliche Weiterentwicklung ihrer Sprache wählen zum grossen Verdruss einer kleinen Reformpartei, die rein persönliche Interessen einiger einzelner verfechten möchte. Auch aus dieser Schwierigkeit werden die Esperantisten siegend hervorgehen. Die sorgfältig versteckten sprachlichen Fehler, welche die Reformsprache enthält, sind aufgedeckt worden, so auch vor allen Dingen die scharf verurteilungswürdigen Manipulationen der Urheber der Verschlechterungen, Reformen genannt. Somit ist es anzunehmen, dass auch die nächstjährigen Kongresse die Einheitlichkeit von neuem betonen werden, sofern die Reformer es nicht vorziehen wollen unverstanden jährlich eine neue Sprache zu erlernen."

In this connection I will make a statement that may be surprising to many. While traveling through Europe last year I met a Dutch gentleman born and raised in Java. He is a lawyer by profession and if I mistake not has large business interests in the Dutch colonies. While discussing the problem of an international

language, he offered with great seriousness the proposition that in his opinion the introduction of Malay as a world-language would be the best and most practical way to do away with further vain attempts at constructing an international tongue. He said—and was positive about the correctness of his statement,—that Malay is the easiest language to acquire, that no language, natural or artificial, would be simpler in its construction or more easy in pronunciation, that it could be learned without effort of any kind, and in addition was spoken by many millions of people throughout the East Indies. It is ready made and has passed through a course of experience by practical use throughout the Dutch colonies, and Esperanto in its original and its reformed Ido are by far more difficult and complicated.

EDITOR.

EXPERIENCE DE DOUBLE TRADUCTION EN LANGUE INTERNATIONALE.

Beaucoup de philosophes croient encore que, si la langue internationale peut bien servir aux besoins de la vie courante ou même des sciences exactes, elle est incapable de rendre avec quelque précision les pensées philosophiques. Pour mettre la langue internationale à l'épreuve dans ce domaine particulièrement ardu, j'ai traduit trois morceaux philosophiques, un allemand, un anglais et un français, empruntés à trois auteurs illustres: MM. Gomperz, W. James et Poincaré; et pour que l'expérience fût plus probante, j'ai prié MM. Gomperz et James de m'indiquer eux-mêmes dans leurs œuvres le morceau qu'ils jugeaient le plus approprié à cette épreuve. De ces morceaux, le plus difficile, sans comparaison, était l'allemand, tant par la langue même (la plus malaisée à traduire en n'importe quelle autre) que par le style particulièrement élégant, littéraire et raffiné de l'auteur (*Vie et action de Socrate,* en *Griechische Denker,* tome 2, pages 36-41). C'est du reste ce qu'ont reconnu tous ceux à qui j'ai distribué ces trois traductions pendant le Congrès de Heidelberg (septembre 1908).

Or M. le prof. Pfaundler, de Graz, sans m'avertir ni me consulter, a entrepris de retraduire en allemand le morceau de M. Gomperz, dont il ne connaissait pas l'original, d'après ma traduction en *Ido* (nom conventionnel et provisoire de la *Langue internationale de la Délégation*). Je n'ai pas voulu voir sa traduction, et lui ai conseillé de l'envoyer directement à M. Gomperz (son collègue de

l'Académie des Sciences de Vienne). M. Gomperz lui a répondu comme suit:

"Suivant votre désir, je me suis empressé de comparer à l'original le morceau traduit d'Ido en allemand, que vous avez eu l'amabilité de m'envoyer; et je l'ai trouvé étonnement fidèle dans l'ensemble. Les divergences très rares (une demi-douzaine en 5 pages de mon livre) sont imputables (si l'on peut parler de responsibilité en de tels détails) en partie à M. Couturat, et en partie à l'ambiguité des expressions de l'original. Une fois vous avez employé une expression inexacte, par une distraction manifeste; mais en aucun cas un reproche quelconque n'atteint la langue internationale...." (Suit l'énumération des 6 erreurs).

"Je reconnais donc volontiers que cette épreuve a extraordinairement bien réussi, et que , pour autant qu'elle est probante, elle est favorable à un haut degré à votre opinion de l'applicabilité de la langue internationale." (Signé) Th. Gomperz.

On doit remarquer que l'expérience n'a pas été faite dans les circonstances les plus favorables: le premier traducteur est philosophe, mais non Allemand; le second est de langue allemande, mais non philosophe (physicien). Enfin le sens de certains mots techniques n'a pas encore été suffisamment fixé, soit par les dictionnaires de la L. I. soit par l'usage. Et l'original abondait en expression très littéraires et peu communes, comme: "anmasslicher Querkopf oder Besserwisser," "arbeitsscheuen Tagdiebes," qui sont presque des idiotismes intraduisibles. Il serait intéressant de faire une expérience analogue avec une traduction en langue nationale (par ex. avec la traduction des *Penseurs grecs* par M. Aug. Reymond): il est probable que les divergences seraient bien plus nombreuses et plus importantes. Quoi qu'il en soit, avec les petites fautes qui en attestent la sincérité, l'expérience est entièrement favorable à la langue internationale. Nous remercions M. Gomperz d'avoir bien voulu nous permettre de publier son témoignage; et nous espérons qu'on ne contestera plus désormais la possibilité d'exprimer ou de traduire avec exactitude, dans une langue internationale, les pensées les plus hautes de la littérature et de la philosophie.

L. COUTURAT.

P. S. Pour éviter toute fausse interprétation, nous tenons à spécifier que ce succès a été obtenu uniquement par la Langue internationale de la Delegation, élaborée par un Comité internationale de savants et de linguistes très compétants.

A MAGIC CUBE OF SIX.

Probably it can be said with truth that the construction of magic squares and cubes has in itself no immediate utility. Benjamin Franklin, who devised some squares possessing remarkable properties, expresses himself as believing that he might have spent his time to better advantage, and the same thought has been uttered many times by others. As an intellectual recreation, however, and as a means of quickening one's insight into the properties and relations of numbers, this study has real value.

In an admirable work recently published on the subject of *Magic Squares and Cubes,* the author, Mr. W. S. Andrews, after developing very clearly the method of constructing magic cubes of odd numbers and of those divisible by four, passes over the problem of cubes of oddly-even numbers (6, 10, 14, etc.) as not yet solved, though he remarks that he does not believe them mathematically impossible. It was on his suggestion that my attention was turned to the question, and a method soon presented itself of attaining at least a partial solution.

In the first place six magic squares were constructed, exactly similar in plan except that three of them began (at the upper left-hand corner) with odd numbers, each of which was 1 or 1 plus a multiple of 36, and the other three with even numbers, each a multiple of 18. In the first three squares the numbers were arranged in ascending order, in the other three descending. The initial numbers were so chosen that their sum was 651, or $\frac{n}{2}(n^3+1)$, which is the proper summation for each dimension of the projected magic cube. In the construction of these original squares, by the way, the diagrams devised by Mr. Andrews and presented in his book proved a great convenience and saved much time.

Each of the six squares so made is "magic" in that it has the same sum (651) for each column, horizontal row and corner diagonal. As the initial numbers have the same sum the similarity of the squares, with ascending arrangement in one half and descending in the other half, insures the same totals throughout for numbers occupying corresponding cells in the several squares; e. g., taking the third number in the upper row of each square and adding the six together we reach the sum 651, and so for any other position of the thirty-six.

In constructing our cube we may let the original six squares

Fig. 1.

I

1	215	214	3	212	6
210	8	208	207	11	7
204	203	15	16	14	199
13	17	201	202	200	18
12	206	9	10	209	205
211	2	4	213	5	216

II

198	20	21	196	23	193
25	191	27	28	188	192
31	32	184	183	185	36
186	182	34	33	35	181
187	29	190	189	26	30
24	197	195	22	194	19

III

37	179	178	39	176	42
174	44	172	171	47	43
168	167	51	52	50	163
49	53	165	166	164	54
48	170	45	46	173	169
175	38	40	177	41	180

IV

145	71	70	147	68	150
66	152	64	63	155	151
60	59	159	160	158	55
157	161	57	58	56	162
156	62	153	154	65	61
67	146	148	69	149	72

V

144	74	75	142	77	139
79	137	81	82	134	138
85	86	130	129	131	90
132	128	88	87	89	127
133	83	136	135	80	84
78	143	141	76	140	73

VI

126	92	93	124	95	121
97	119	99	100	116	120
103	104	112	111	113	108
114	110	106	105	107	109
115	101	118	117	98	102
96	125	123	94	122	91

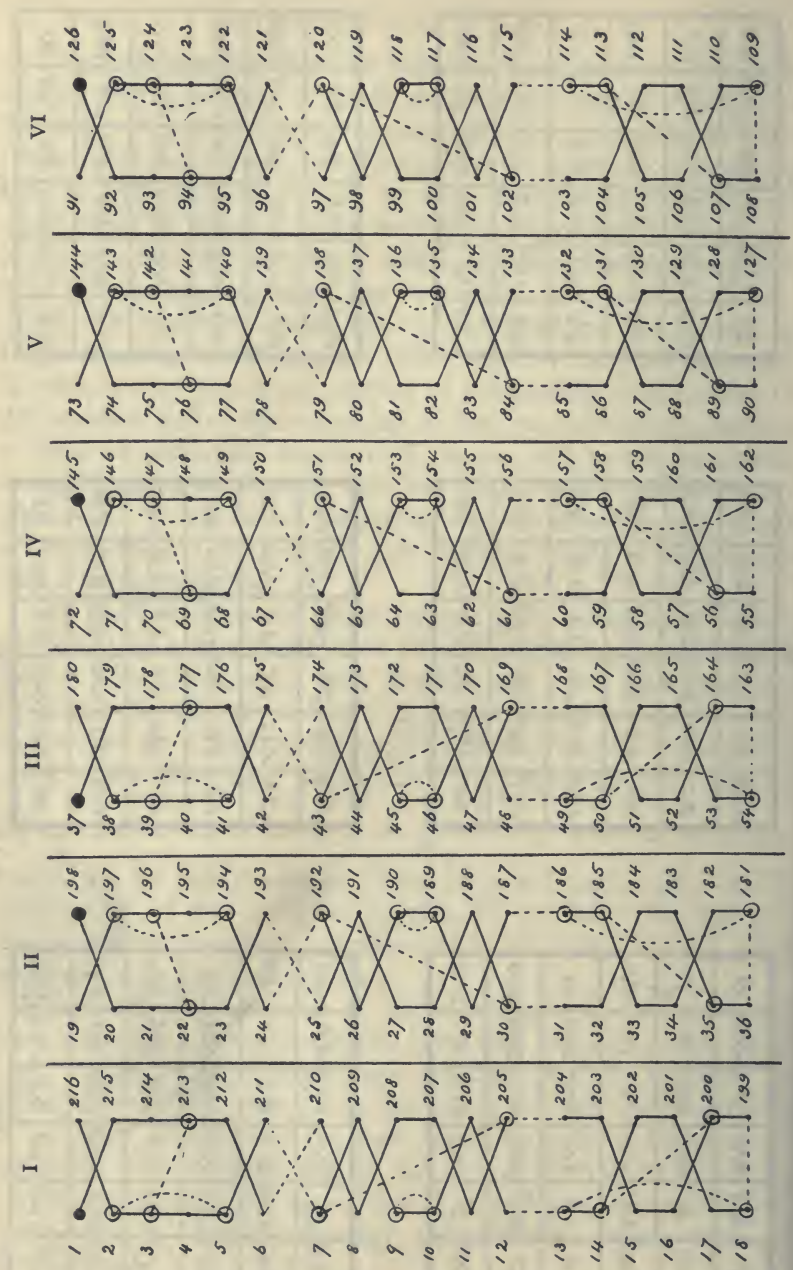

Fig. 2.

serve as the horizontal layers or strata. We have seen that the vertical columns in the cube must by construction have the correct summation. Furthermore, as the successive right-and-left rows in the horizonal squares constitute the rows of the vertical squares facing the front or back of the cube, and as the columns in the horizontal squares constitute the rows of the vertical squares facing right or left, it is easily seen that each of these twelve vertical squares has the correct summation for all its columns and rows.

Here appears the first imperfection of our cube. Neither the diagonals of the vertical squares nor those of the cube itself have the desired totals, though their *average* footing is correct. It is true further that the footings of the two cubic diagonals originating at opposite extremities of the same plane diagonal average 651, though neither alone is right.

At this point, however, we come upon an interesting fact. While the cubic diagonals vary, the two half-diagonals originating at opposite extremities of either plane diagonal in either the upper or the lower face, and meeting at the center of the cube, together have the sum 651. These correspond in the cube to the "bent diagonals" of Franklin's "square of squares." Of course a moment's reflection will show that this feature is inevitable. The original squares were so constructed that in their diagonals the numbers equidistant from the middle were "complementary", that is, taken together they equaled 217, or n^3+1, n representing the number of cells in a side of the square. In taking one complementary pair from each of three successive squares to make our "bent diagonal" we must of necessity have $3 \times 217 = 651$.

As in the Franklin squares, so in this cube do the "bent diagonals" parallel to those already described have the same totals. A plane square may be thought of as being bent around a cylinder so as to bring its upper edge into contact with the lower, and when this is done with a Franklin square it will be seen that there is one of these "bent diagonals" for each row. In like manner, if it were possible by some fourth-dimension process analogous to this to set our cube upon itself, we should see that there were six (or in general n) "bent diagonals" for each diagonal in each of the horizontal faces, or 24 in all, and all having the same sum, 651.

The fact that each diagonal in the horizontal squares is made up of three pairs of numbers, each pair having the sum 217, suggests an interesting study. Figure 3 represents a vertical section of the cube in the plane of a diagonal of the upper face. The dotted lines

connect numbers, one pair from each of three rows, and in each case the sum of the six numbers is 651. The series represented in the figure—1 119 51 166 98 216, 1 112 8 209 105 216, 1 184 152 65 33 216, 8 126 130 87 91 209, 15 144 119 98 73 202—have each the same total, 651, and the lines connecting the numbers outline some graceful and symmetrical figures. Many more might be drawn, but these examples will illustrate the principle.

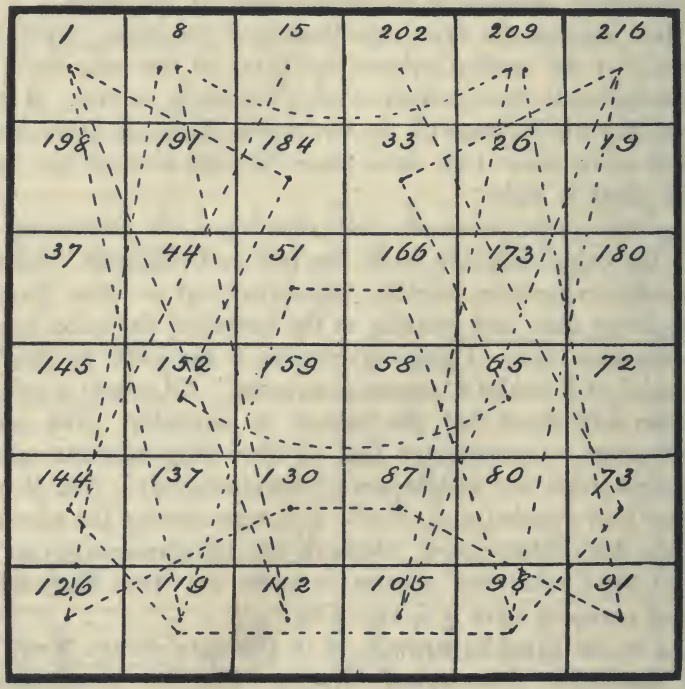

Fig. 3.

Omitting the series described in the last paragraph, which are rather fanciful than natural features of the cube, we may recapitulate the number of occurrences of the characteristic number 651 thus:

In the vertical columns	36 or	n^2
In the rows from front to back	36 or	n^2
In the rows from right to left.....	36 or	n^2
In the diagonals of the original squares ..	12 or	$2n$
In the cubic "bent diagonals"	24 or	$4n$
	144 or	$3n^2+6n$

The column of n values at the right represents the "general" numbers, found in cubes of 10, 14, etc., as well as in that of 6.

All these characteristics are present no matter in what order the original squares are piled, which gives us 720 permutations. Furthermore, only one form of magic square was employed, and Mr. Andrews has printed diagrams to illustrate at least 128 forms, any one of which might have been used in the construction of our cube. Still further, numerous transpositions within the squares are possible—always provided the vertical totals are guarded by making the same transpositions in two squares, one ascending and the other descending. From this it is easy to see that the numbers 1-216 may be arranged in a very great number of different ways to produce such a cube.

So much for the general arrangement. If we so pile our original squares as to bring together the three which begin with odd numbers and follow them with the others (or *vice versa*) we find some new features of interest. In the arrangement already discussed none of the vertical squares has the correct sum for any form of diagonal. The arrangement now suggested shows "bent diagonals" for the vertical squares facing right and left as follows: Each of the outside squares—at the extreme right or left—has four "bent diagonals" facing the upper and four facing the lower edge. These have their origin in the first, second, fourth and fifth rows moving upward or downward, i. e., in the first two rows of each group—those yielded by original squares starting with odd and those with even numbers. Each of the four inside vertical squares has but two "bent diagonals" facing its upper and two facing its lower edge, and these start in the first and fourth rows—the first of each group of three. This will be true no matter in what order the original squares are piled, provided the odd ones are kept together and the evens together. This will add 32 (8 for each of the two outer and 4 for each of the four inner squares) to the 144 appearances of the sum 651 tabulated above, making 176; but this will apply, of course, only to the cube in which the odd squares are successive and the even squares successive. As the possible permutations of three objects number 6, and as each of these permutations of squares beginning with odd numbers can be combined with any one of the equal number of permutations of the even squares, a total of 36 arrangements is possible.

While the straight diagonals of these squares do not give the required footing the two in each square facing right or left average

that sum: thus the diagonals of the left-hand square have totals of 506 and 796, of the second square 708 and 594, third 982 and 320, fourth 596 and 706, fifth 798 and 504, and the right-hand square 986 and 316, each pair averaging 651. I have not yet found any arrangement which yields the desired total for the diagonals, either straight or bent, of the vertical squares facing back or front; nor do their diagonals, like those just discussed, average 651 for any single square, though that is the exact average of the whole twelve.

By precisely similar methods we can construct cubes of 10, 14, 18, and any other oddly-even number, and find them possessed of the same features. I have written out the squares for the magic cube of 10, but time would fail to carry actual construction into higher numbers. Each column and row in the 10-cube foots up 5005, in the 14-cube 19,215, in the 30-cube 405,015, and in a cube of 42 no less than 1,555,869! Life is too short for the construction and testing of squares and cubes involving such sums.

That it is possible to build an absolutely "perfect" cube of 6 is difficult to affirm and dangerous to deny. The present construction fails in that the ordinary diagonals of the vertical squares and of the cube itself are unequal, and the difficulty is made to appear insuperable from the fact that while the proper summation is 651, an odd number, all the refractory diagonals are even in their summation.

The figures which accompany this article were drawn for it by Mr. Andrews, who has taken a lively interest in the cube and its properties. Especially valuable are the diagrams in Figure 2, showing how the numbers of the natural series 1-216 are arranged in the squares which constitute the cube. This is a device of Mr. Andrews's own invention, and certainly is ingenious and beautiful. The diagrams here given for squares of six can be expanded on well-defined principles to apply to those of any oddly-even number, and several of them are printed in the book already mentioned.

It will be noticed that the numbers 1-108 are placed at the left of the diagrams, and those from 109 to 216 inclusive at the right in inverse order. Consequently the sum of those opposite each other is everywhere 217. In each diagram are two pairs of numbers connected by dotted lines and marked ○. These in every case are to be interchanged. Starting then at the heavy dot at the top we follow the black line across to 215, down to 212 (substituting 3 for 213) and back to 6; then across on the dotted line to 210 and along the zigzag black line to 8, 208, 207, 11 and 7 (interchanged with 205);

down the dotted line to 204, then to 203, 15, 16, 14 (in place of 200), 199; then across the diagram and upward, observing the same methods, back to 216. This gives us the numbers which constitute our square No. I, written from left to right in successive rows. In like manner the diagrams in column II give us square No. II, and so on to the end. It is worthy of notice that in the fourth column of diagrams the numbers are written in the reverse of their natural order. This is because it was necessary in writing the fourth square to begin with the number 145 (which naturally would be at the bottom of the diagram) in order to give the initial numbers the desired sum of 651.

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A NEW METHOD FOR MAKING MAGIC SQUARES OF AN ODD DEGREE.

In an endeavor to discover a general rule whereby all forms of magic squares might be constructed, and thereby to solve the question as to the possible number of squares of the fifth order, a method was devised whereby squares may be made, for whose construction the rules at present known to the writer appear to be inadequate.

A *general rule,* however, seems as yet to be unattainable; nor does the solution of the possible number of squares of an order higher than four seem to be yet in sight, though, because of the discovery, so to speak, of hitherto unknown variants, the goal must, at least, have been brought nearer to realization.

The new method now to be described does not pretend to be other than a partial rule, i. e., a rule by which most, but possibly not *all* kinds of magic squares may be made. It is based on De La Hire's method, i. e., on the implied theory that a normal magic square is made up of two primary squares, the one superimposed on the other and the numbers in similarly placed cells added together. This theory is governed by the fact that a given series of numbers may be produced by the consecutive addition of the terms of two or more diverse series of numbers. For example, the series of natural numbers from one to sixteen may be regarded (*a*) as a single series, as stated, or (*b*) as the result of the addition, successively, of all the terms of a series of eight terms to those of another series of two terms. For example, if series No. 1 is composed of 0-1-2-3-4-5-6

and 7 and series No. 2 is composed of 1 and 9, all the numbers from 1 to 16 may be thus produced. Or (*c*) a series of four numbers, added successively to all the terms of another series of four numbers, will likewise produce the same result, as for example 0-1-2 and 3, and 1-5-9 and 13.

Without undertaking to trace out the steps leading up to the rule to be described, we will at once state the method in connection with a 5×5 square. First, two primary squares must be made, which will hereafter be respectively referred to as the A and B primary squares. If the proposed magic square is to be *regular*, that is, if its complementary couplets are to be arranged geometrically equidistant from the center, the central cell of each square must naturally be occupied by the central number of the series of which the square is composed. The two series in this case may be 1-2-3-4-5 and 0-5-10-15-20. The central number of the first series being 3 and of the second series 10, these two numbers must occupy the central cells of their respective squares.

	3			
3				
		3		
				3
			3	

Fig. 1.

			10	
				10
		10		
10				
	10			

Fig. 2.

				3
	3			
		3		
			3	
3				

Fig. 3.

In each of these squares, each of the terms of its series must be represented five times, or as many times as the series has terms. Having placed 3 and 10 in their respective central cells, four other cells in each square must be similarly filled. To locate these cells, any geometrical design may be selected which is *balanced* about the central cell. Having done this in primary square A the *reverse* of the same design must be taken for primary square B, two examples being shown in Figs. 1 and 2 and Figs. 3 and 4.

Having selected a design, the next step will be to fill the *central* row, which may be done by writing in any of the four empty cells in this row, any of the four remaining terms of the series. The opposite cell to the one so filled, must then be filled with the complementary number of the one last entered. Next, in either of the two remaining empty cells, write either of the remaining two terms

of the series, and, in the last empty cell the then remaining number, which will complete the central row as shown in Fig. 5. All the other rows in the square must then be filled, using the same *order*

10				
			10	
		10		
	10			
				10

Fig. 4.

	(3)			
(3)				
4	1	(3)	5	2
				(3)
			(3)	

Fig. 5.

1	(3)	5	2	4
(3)	5	2	4	1
4	1	(3)	5	2
5	2	4	1	(3)
2	4	1	(3)	5

Fig. 6.

of numbers as in this *basic* row, and the square will be completed as shown in Fig. 6. The second square can then be made up with the numbers of its series in exactly the same way, as shown in Fig. 7.

5	15	0	(10)	20
20	5	15	0	(10)
15	0	(10)	20	5
(10)	20	5	15	0
0	(10)	20	5	15

Fig. 7.

6	18	5	12	24
23	10	17	4	11
19	1	13	25	7
15	22	9	16	3
2	14	21	8	20

Fig. 8.

				(3)
	(3)			
		(3)		
			(3)	
(3)				

Fig. 9.

Adding together the terms of Figs. 6 and 7, will give the regular 5×5 magic square shown in Fig. 8, which can not be made by any previously published rule known to the writer. Another example

4	5	1	2	(3)
2	(3)	4	5	1
1	2	(3)	4	5
5	1	2	(3)	4
(3)	4	5	1	2

Fig. 10.

(10)	5	0	20	15
0	20	15	(10)	5
20	15	(10)	5	0
15	(10)	5	0	20
5	0	20	15	(10)

Fig. 11.

14	10	1	22	18
2	23	19	15	6
21	17	13	9	5
20	11	7	3	24
8	4	25	16	12

Fig. 12.

may be given to impress the method on the student's mind, Fig. 9 showing the plan, Figs. 10 and 11 the A and B primary squares, and Fig. 12 the resulting magic square. Any odd square can be readily

made by this method, a 7×7 being shown. Fig. 13 shows the plan, Figs. 14 and 15 being the primary squares and 16 the complete example. Returning to the 5×5 square, it will be seen that in filling out the central row of the A primary square Fig. 5, for the first of the four empty cells, there is a choice of 16, and next a choice

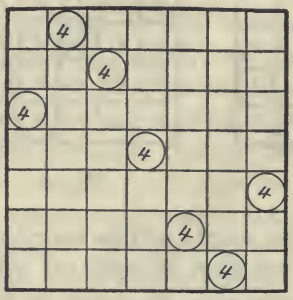

Fig. 13.

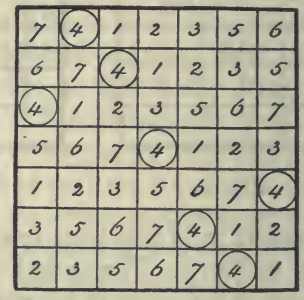

Fig. 14.

of four. Also for the B primary square there are the same choices. Hence we have

$$(16 \times 4)^2 = 4096 \text{ choices.}$$

In addition to this, by *reversing* the *patterns* in the two primary squares, the above number can be doubled.

Fig. 15.

Fig. 16.

It is therefore evident that with any chosen geometrical plan, 8192 variants of regular 5×5 squares can be produced, and as at least five distinct plans can be made, 40,960 different 5×5 *regular* squares can thus be formed. This however is not the limit, for the writer believes it to be a law that all *"figures of equilibrium"* will

produce magic squares as well as *geometrically* balanced diagrams or plans.

Referring to Fig. 17, if the circles represent equal weights connected as by the dotted lines, the system would balance at the center of the square. This therefore is a "figure of equilibrium" and it may be used as a basis for magic squares, as follows: Fill the marked cells with a number, as for example 1 as in Fig. 18; then

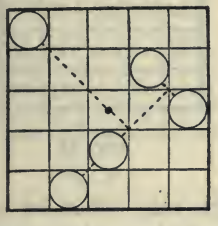

Fig. 17.

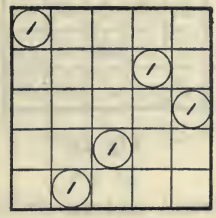

Fig. 18.

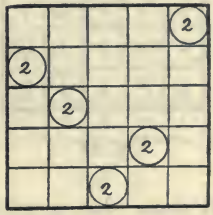

Fig. 19.

with the other numbers of the series, (excepting only the central number) make three other similar "figures of equilibrium" as shown separately in Figs. 19, 20 and 21, and collectively in Fig. 22. The four cells remaining empty will be geometrically balanced, and must be filled with the middle terms of the series (in this instance 3) thus completing the A primary square as shown in Fig. 23. Fill the B primary square with the series 0-5-10-15-20 in the same manner as

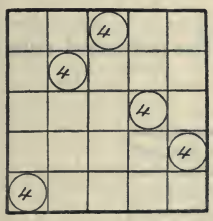

Fig. 20.

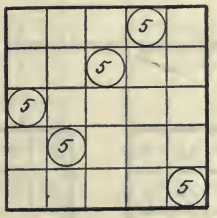

Fig. 21.

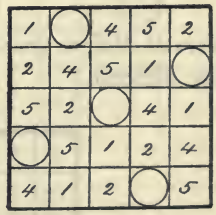

Fig. 22.

above described and as shown in Fig. 24. The combination of Figs. 23 and 24 produces the regular magic square given in Fig. 25.

There are at least five different "figures of equilibrium" that can be drawn in a 5×5 square, and these can be readily shown to give as many variants as the geometrical class, which as before noted yield 40,960 different squares. This number may therefore now be doubled raising the total to 81,920 regular 5×5 magic

squares, that are capable of being produced by the rules thus far considered.

The student must not however imagine that the possibilities of this method are now exhausted, for a further study of the subject

1	(3)	4	5	2
2	4	5	1	(3)
5	2	(3)	4	1
(3)	5	1	2	4
4	1	2	(3)	5

Fig. 23.

5	0	15	10	20
10	20	0	15	5
20	15	10	5	0
15	5	20	0	10
0	10	5	20	15

Fig. 24.

6	3	19	15	22
12	24	5	16	8
25	17	13	9	1
18	10	21	2	14
4	11	7	23	20

Fig. 25.

will show that a geometrical pattern or design may often be used not only with its own reverse as shown, but also with another *entirely*

0	5	15	20	(10)
5	15	20	(10)	0
15	20	(10)	0	5
20	(10)	0	5	15
(10)	0	5	15	20

Fig. 26.

(3)	1	2	4	5
5	(3)	1	2	4
4	5	(3)	1	2
2	4	5	(3)	1
1	2	4	5	(3)

Fig. 27.

2	4	1	(3)	5
(3)	5	2	4	1
4	1	(3)	5	2
5	2	4	1	(3)
1	(3)	5	2	4

Fig. 28.

different design, thus rendering our search for the universal rule still more difficult.

3	6	17	24	15
10	18	21	12	4
19	25	13	1	7
22	14	5	8	16
11	2	9	20	23

Fig. 29.

2	9	16	23	15
8	20	22	14	1
19	21	13	5	7
25	12	4	6	18
11	3	10	17	24

Fig. 30.

For example the pattern shown in Fig. 26 may be combined in turn with its reverse shown in Fig. 27 and also with Fig. 28, making the two regular magic squares shown in Figs 29 and 30.

In consideration of this as yet unexplored territory, therefore, the rules herein briefly outlined can only be considered as partial, and fall short of the "universal" rule for which the writer has been seeking. Their comprehensiveness however is evidenced by the fact that *any square* made by any other rule heretofore known to the

4	2	5	(3)	1
(3)	1	4	2	5
2	5	(3)	1	4
1	4	2	5	(3)
5	(3)	1	4	2

Fig. 31.

2	(3)	4	5	1
4	5	1	2	(3)
1	2	(3)	4	5
(3)	4	5	1	2
5	1	2	(3)	4

Fig. 32.

(3)	1	4	2	5
5	(3)	1	4	2
2	5	(3)	1	4
4	2	5	(3)	1
1	4	2	5	(3)

Fig. 33.

writer, may be made by these rules, and also a great variety of other squares, which may only be made with great difficulty, if at all, by the older methods.

To show the application of these rules to the older methods, a few squares given by Mr. Andrews in his recent book on *Magic Squares and Cubes* may be analyzed.

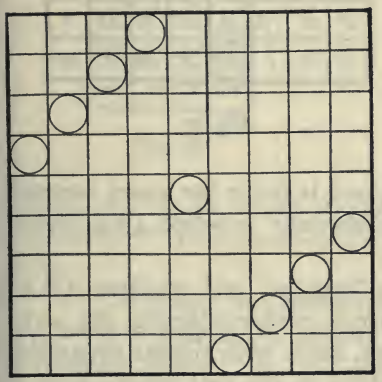

Fig. 34.

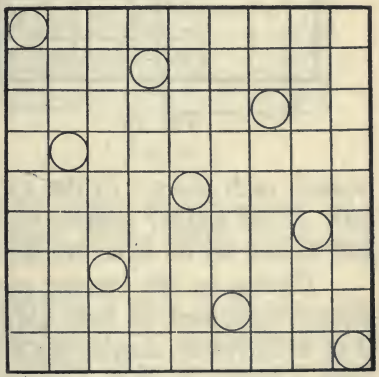

Fig. 35.

Figs. 31, 32 and 33 show the plans of 5×5 squares given in Figs. 22, 23 and 41 in the above mentioned book.

Their comprehensiveness is still further emphasized in squares of larger size, as for example in the 7×7 square shown in Fig. 16, which can not be constructed by any of the older methods known

to the writer. Two final examples are shown in Figs. 34 and 35 which give plans of two 9×9 squares which if worked out will be found to be unique and beyond the power of any other rule to produce. In conclusion an original and curious 8×8 square is submitted in Fig. 39. This square is both "regular" (in the sense of being centrally balanced) and "continuous" or "Nasik," inasmuch as all constructive diagonals give the correct summation, a combination of two qualities which is believed to be new in squares of 8×8.

The theory upon which the writer proceeded in the construction of this square was to consider it as a compound square composed of four 4×4 squares, the latter being in themselves "continuous" but not "regular." That the latter quality might obtain in the 8×8

1	14	7	12	B			
15	4	9	6				
10	5	16	3				
8	11	2	13				C
A				4	15	6	9
				14	1	12	7
				11	8	13	2
			D	5	10	3	16

Fig. 36.

1	14	7	12	3	16	5	10
15	4	9	6	13	2	11	8
10	5	16	3	12	7	14	1
8	11	2	13	6	9	4	15
2	13	8	11	4	15	6	9
16	3	10	5	14	1	12	7
9	6	15	4	11	8	13	2
7	12	1	14	5	10	3	16

Fig. 37.

square, each *quarter* of the 4×4 square is made the exact counterpart of the similar *quarter* in the diagonally opposite 4×4 square, but turned on its axis 180 degrees.

Having in this manner made a "regular" and continuous 8×8 square composed of four 4×4 squares, each containing the series 1 to 16 inclusive, another 8×8 square, made with similar properties, with a proper number series and added to the first square term to term will necessarily yield the desired result.

Practically, the work was done as follows: In one quarter of an 8×8 square, a "continuous" (but not "regular") 4×4 square was inscribed, and in the diagonally opposite quarter another 4×4 square was written in the manner heretofore described and now illustrated in Fig. 36. A simple computation will show that in the unfilled parts of Fig. 36, if it is to be "continuous," the contents of the cells

C and D must be 29 and A and B must equal 5. Hence A and B may contain respectively 1 and 4, or else 2 and 3. Choosing 2 and 3 for A and B, and 14 and 15 for D and C, they were located as marked by circles in Fig. 37, the "regular" or centrally balanced idea being thus preserved.

The other two quarters of the 8×8 square were then completed in the usual way of making nasik 4×4 squares, thus producing the A primary square shown in Fig. 37, which, in accordance with our theory must be both "regular" and "continuous" which inspection confirms.

As only the numbers in the series 1 to 16 inclusive appear in this square, it is evident that they must be combined term by term, with another square made with the series 0-16-32-48 in order that the final square may contain the series 1 to 64 inclusive. This is accom-

0	48	32	16
48	0	16	32
16	32	48	0
32	16	0	48

Fig. 38.

1	14	55	60	35	48	21	26
15	4	57	54	45	34	27	24
58	53	16	3	28	23	46	33
56	59	2	13	22	25	36	47
18	29	40	43	52	63	6	9
32	19	42	37	62	49	12	7
41	38	31	20	11	8	61	50
39	44	17	30	5	10	51	64

Fig. 39.

plished in Fig. 38, which shows a 4×4 square both "regular" and "continuous," composed of the numbers in the above mentioned series.

At this point, two courses of operation seemed to be open, the first being to expand Fig. 38 into an 8×8 square, as in the case of the A primary square, Fig. 37, and the second being to consider Fig. 37 as a *4×4 square*, built up of sixteen subsquares of 2×2 regarded as units.

The latter course was chosen as the easier one, and each individual term in Fig. 38 was added to each of the four numbers in the corresponding quadruple cells of Fig. 37, thus giving four terms in the complete square as shown in Fig. 39. For example 0 being the term in the upper left-hand cell of Fig. 38, this term was added to 1-14-15-4 in the first quadruple cell of Fig. 37, leaving these numbers

unchanged in their value, so they were simply transferred to the complete magic square Fig. 39. The second quadruple cell in Fig. 37 contains the numbers 7-12-9-6, and as the second cell in Fig. 38 contains the number 48, this number was added to each of the last mentioned four terms, converting them respectively into 55-60-57 and 54, which numbers were inscribed into the corresponding cells of Fig. 39, and so on throughout.

Attention may here be called to the "figure of equilibrium" shown in Fig. 38 by circles and its quadruple reappearance in Fig. 39 which is a complete "regular" and "continuous" 8×8 magic square, having many unique summations.

The writer wishes to express his gratitude to his friend, and fellow student, Mr. W. S. Andrews, of Schenectady, New York, for having executed the diagrams illustrating this article and other incidental assistance. It is exceedingly doubtful whether this contribution to the literature of magic squares would ever have seen the light of day without his generous aid.

L. S. FRIERSON.

FRIERSON, LA.

OVERLAPPING MAGIC SQUARES.*

A peculiar species of Compound Squares may be called overlapping magic squares. In these the division is not made as usual by some factor of the root into four, nine, sixteen or more subsquares of equal area, but into several subsquares or panels not all of the same size, some lying contiguous, while others overlap. The simplest specimens have two minor squares of equal measure apart in opposite corners, and in the other corners two major squares which overlap at the center, having as common territory a middle square 2×2, 3×3, or larger, or only a single cell. Such division can be made whether the root of the square is a composite or a prime number, as 4-5-9; 4-6-10; 5-6-11; 6-9-15; 8-12-20 etc. The natural series 1 to n^2 may be entered in such manner that each subsquare shall be magic by itself, and the whole square also magic to a higher or lower degree. For example the 9-square admits of division into two minor squares 4×4, and two major squares 5×5 which overlap in the center having one cell in common. For convenience, the process of construction may begin with an orderly arrangement of materials.

*The diagrams have been drawn by Mr. W. S. Andrews of Schenectady, New York.

The series 1 to 81 is given in Fig. 1, which may be termed a *primitive square*. The nine natural grades of nine terms each, appear in direct order on horizontal lines. It is evident that any natural series 1 to n^2 when thus arranged will exhibit n distinct grades of n terms each, the common difference being unity in the horizontal direction, n vertically, $n+1$ on direct diagonals, and $n-1$ on transverse diagonals. This primitive square is therefore something more than a mere assemblage of numbers, for, on dividing it as proposed, there is seen in each section a set of terms which may be handled as regular grades, and with a little manipulation may become magical. The whole square with all its component parts may be tilted over to right or left 45°, so that all grades will be turned into a diagonal direction, and all diagonals will become rectangular rows, and presto,

1	2	3	4	5	6	7	8	9
10	11	12	13	14	15	16	17	18
19	20	21	22	23	24	25	26	27
28	29	30	31	32	33	34	35	36
37	38	39	40	41	42	43	44	45
46	47	48	49	50	51	52	53	54
55	56	57	58	59	60	61	62	63
64	65	66	67	68	69	70	71	72
73	74	75	76	77	78	79	80	81

Fig. 1.

the magic square appears in short order. The principle has been admirably presented and employed in various connections by Mr. W. S. Andrews in his recent treatise on *Magic Squares and Cubes*, and the process is beautifully illustrated on pp. 17 and 113 of that work. It is a well-known fact that the primitive square gives in its middle rows an average and equal summation; it is also a fact not so generally recognized, or so distinctly stated, that *all* the diagonal rows are already correct for a magic square. Thus in this 9-square the direct diagonal, 1, 11, 21, 31 etc. to 81 is a mathematical series, 4½ normal couplets = 369. Also the parallel partial diagonal 2, 12, 22, 32, etc. to 72, eight terms, and 73 to complete it, = 369. So of all the broken diagonals of that system; so also of all the nine transverse diagonals; each contains 4½ normal couplets or the value

thereof = 369. The greater includes the less, and these features are prominent in the subsquares. By the expeditious plan indicated above we might obtain in each section some squares of fair magical quality, quite regular and symmetrical, but when paired they would not be equivalent, and it is obvious that the coupled squares must have an equal summation of rows, whatever may be their difference of complexion and constitution. The major squares are like those once famous Siamese twins, Eng and Chang, united by a vinculum, an organic part of each, through which vital currents must flow; the central cell containing the middle term 41, must be their bond of union, while it separates the other pair. The materials being parceled out and ready to hand, antecedents above and consequents below, an equitable allotment may be made of normal couplets to each square. Thus from N. W. section two grades may be taken as they stand horizontally, or vertically, or diagonally or any way symmetrically. The consequents belonging to those, found in S. E. section will furnish two grades more and complete the square. The other eight terms from above and their consequents from below will empty those compartments and supply the twin 4-square with an exact equivalent. Some elaborate and elegant specimens, magic to a high degree may be obtained from the following distribution:

1st grade 1, 3, 11, 13 (all odd), 2, 4, 10, 12 (all even);
2d grade 19, 21, 29, 31 and 20, 22, 28, 30.

Then from N. E. section two grades may be taken for one of the major squares; thus 5, 6, 7, 8, 9 and 23, 24, 25, 26, 27 leaving for the twin square, 14, 15, 16, 17, 18 and 32, 33, 34, 35, 36. To each we join the respective consequents of all those terms forming 4th and 5th grades, and they have an equal assignment. But each requires a middle grade, and the only material remaining is that whole middle grade of the 9-square. Evidently the middle portion, 39, 40, 41, 42, 43 must serve for both, and the 37, 38, and their partners 44, 45 must be left out as undesirable citizens. Each having received its quota may organize by any plan that will produce a magic and bring the middle grade near the corner, and especially the number 41 into a corner cell.

In the 5-square Fig. 2 we may begin anywhere, say the cell below the center and write the 1st grade, 14, 15, 16, 17, 18, by a uniform oblique step moving to the left and downward. From the end of this grade a new departure is found by counting two cells down or three cells up if more convenient, and the 2d grade, 32, 33, 34, 35, 36 goes in by the same step of the 1st grade. All the

grades follow the same rule. The leading terms 14, 32, 39, 46, 64 may be placed in advance, as they go by a uniform step of their own, analogous to that of the grades; then there will be no need of any "break move," but each grade can form on its own leader wherever that may stand, making its proper circuit and returning to its starting point. The steps are so chosen and adjusted that every number finds its appointed cell unoccupied, each series often crossing the path of others but always avoiding collision. The resulting square is magic to a high degree. It has its twelve normal couplets arranged geometrically radiating around that unmatched middle term 41 in the central cell. In all rectangular rows and in all diagonals, entire and broken, the five numbers give by addition the constant S = 205. There are twenty such rows. Other remarkable traits might be mentioned.

50	39	33	16	67
34	17	68	46	40
64	47	41	35	18
42	36	14	65	48
15	66	49	43	32

Fig. 2.

23	45	58	73	6
55	70	5	31	44
13	30	41	52	69
38	51	77	12	27
76	9	24	37	59

Fig. 3.

For the twin square Fig. 3, as the repetition of some terms and omission of others may be thought a blemish, we will try that discarded middle grade, 37, 38, 41, 44, 45. The other grades must be reconstructed by borrowing a few numbers from N. W. section so as to conform to this in their sequence of differences, as Mr. Frierson has ably shown (Andrews, p. 152). Thus the new series in line 5-6-9-12-13, 23-24-27-30-31, 37-38-(41)-44-45 etc. has the differences 1 3 3 1 repeated throughout, and the larger grades will necessarily have the same, and the differences between the grades will be reciprocal, and thus the series of differences will be balanced geometrically on each side of the center, as well as the normal couplets. Therefore we proceed with confidence to construct the 5-square Fig. 3 by the same rule as used in Fig. 2, only applied in contrary directions, counting two cells to right and one upward. When completed it will be the reciprocal of Fig. 2 in pattern, equivalent in summation, having only the term 41 in common and possessing similar magical properties. It remains to be seen how those

disorganized grades in the N. W. Section can be made available for the two minor squares. Fortunately, the fragments allow this distribution:

Regular grades 1, 2, 3, 4,—irregular grades 7, 8, 10, 11
19, 20, 21, 22 25, 26, 28, 29

These we proceed to enter in the twin squares Figs. 4 and 5. The familiar two-step is the only one available, and the last half of each grade must be reversed, or another appropriate permutation employed in order to secure the best results. Also the 4th grade comes in before the 3d. But these being consequents, may go in naturally, each diagonally opposite its antecedent. The squares thus made are magical to a very high degree. All rectangular and all diagonal rows to the number of sixteen have the constant $S = 164$. Each quadrate group of four numbers $= 164$. There are nine of these overlapping 2-squares. The corner numbers or two numbers taken on one side together with the two directly opposite $= 164$. The

7	29	71	57
72	56	8	28
11	25	75	53
74	54	10	26

Fig. 4.

1	22	78	63
79	62	2	21
4	19	81	60
80	61	3	20

Fig. 5.

corner numbers of any 3-squares $= 164$. There are four of these overlapping combinations arising from the peculiar distribution of the eight normal couplets.

These squares may pass through many changes by shifting whole rows from side to side, that is to say that we may choose any cell as starting point. In fact both of them have been thus changed when taking a position in the main square. The major squares shown in Figs. 2 and 3 pass through similar changes in order to bring the number 41 to a corner. With these four subsquares all in place we have the 9-square, shown in Fig. 6, containing the whole series 1 to 81. The twenty continuous rows have the constant $S = 164 + 205 = 369$. Besides the 4-squares in N. W. and S. E. there is a 4-square in each of the other corners overlapping the 5-square, not wholly magic but having eight normal couplets placed geometrically opposite, so that taken by fours symmetrically they $= 164$. The four corner numbers $31 + 36 + 22 + 75 = 164$.

This combination may be taken as typical of the odd squares which have a pair of subsquares overlapping by a single cell. Whatever peculiarities each individual may exhibit they must all conform to the requirement of equal summation in coupled subsquares; and for the distribution of values the plan of taking as a unit of measure the normal couplet of the general series is so efficacious and of so universal application that no other plan need be suggested. These principles apply also to the even squares which have no central cell but a block of four cells at the intersection of the axes. For example, the 14-square, Fig. 7, has two minor subsquares 6×6, and two major squares 8×8, with a middle square 2×2. This indicates a convenient subdivision of the whole area into 2-squares. Thus in N. W. Section we have sixteen blocks; it is a quasi-4-square, and

75	53	11	25	14	65	48	42	36
10	26	74	54	49	43	32	15	66
71	57	7	29	33	16	67	50	39
8	28	72	56	68	46	40	34	17
52	69	13	30	41	35	18	64	47
12	27	38	51	77	80	20	3	61
37	59	76	9	24	4	60	81	19
73	6	23	45	58	79	21	2	62
31	44	55	70	5	1	63	78	22

Fig. 6.

the compartments may be numbered from 1 to 16 following some approved pattern of the magic square, taking such point of departure as will bring 16 to the central block. This is called 1 for the S. E. section in which 2, 3 etc. to 16 are located as before. Now as these single numbers give a constant sum in every line, so will any mathematical series that may replace them in the same order as 1st, 2d, 3d terms etc. Thus in 1 the numbers 1, 2, 3, 4, in 2; 5, 6, 7, 8, and so on by current groups, will give correct results. In this case the numbers 1 to 18, and 19 to 36 with their consequents should be reserved for the twin minor squares. So that here in the N. W. section we begin with 37, 38, in 1 instead of 1, 2, leaving the 3, 4 spaces to be occupied by the consequents 159, 160. Then in 2 we continue 39, 40 (instead of 5, 6) and so on following the path of the

primary series, putting two terms into each 2-square, and arriving with 67, 68 at the middle square. Then the coupled terms go on 69, 70 = 71, 72 etc. by some magic step across the S. E. section reaching the new No. 16 with the terms 97, 98. This exhausts the antecedents. Each 2-square is half full. We may follow a reversed track putting in the consequents 99, 100 etc. returning to the starting point with 159, 160. It is evident that all the 2-squares are equivalent, and that each double row of four of them = 1576, but it does not follow that each single row will = 788. In fact they

47	149	65	131	56	142	44	154	7	18	193	4	185	184
48	150	66	132	55	141	43	153	186	6	187	194	1	17
57	139	39	157	50	148	62	136	9	15	163	8	181	195
58	140	40	158	49	147	61	135	185	16	13	190	182	2
145	51	133	63	138	60	160	38	12	196	10	3	191	179
146	52	134	64	137	59	159	37	189	180	5	192	11	14
143	53	155	41	152	46	130	68	108	90	103	93	115	81
144	54	156	42	151	45	129	67	107	89	104	94	116	82
25	36	175	22	167	166	99	97	121	75	126	72	114	84
168	24	169	176	19	35	100	98	122	76	125	71	113	83
27	33	165	26	163	177	73	123	85	111	96	102	78	120
170	34	31	172	164	20	74	124	86	112	95	101	77	119
30	178	28	21	173	161	91	105	79	117	70	128	88	110
171	162	23	174	29	32	92	106	80	118	69	127	87	109

Fig. 7.

do so, but that is due to the position of each block as direct or reversed or inverted according to a chart or theorem employed in work of this kind. The sixteen rectangular rows, the two entire diagonals and those which pass through the centers of the 2×2 blocks sum up correctly. There are also many bent diagonals and zigzag rows of eight numbers that = 788. Each quarter of the square = 1576 and any overlapping 4-square made by four of the blocks gives the same total. The minor squares are *inlaid*. Thus in the N. E. square if the twenty numbers around the central block be dropped out and the three at each angle be brought together around

the block we shall have a 4-square magical to a high degree. In fact this is only reversing the process of construction.

Fig. 8 is a 15-square which develops the overlapping principle to an unusual extent. There are two minor squares 6×6, and two major squares 9×9 with a middle square 3×3 in common. The whole area might have been cut up into 3-squares. The present division was an experiment that turned out remarkably well. The general series, 1 to 225 is thus apportioned. For N. W. 6-square the numbers 1 to 18 and 208 to 225; for S. E. 19 to 36 and 190 to

225	216	3	222	5	7	73	143	75	141	77	139	79	152	138
10	1	223	4	221	219	153	83	151	85	149	87	147	88	74
6	220	11	18	212	211	89	129	91	127	93	136	126	81	145
218	8	213	210	12	17	137	97	135	99	133	100	90	82	144
2	224	14	15	215	208	101	119	103	124	118	95	181	150	76
217	9	214	209	13	16	125	107	123	108	102	96	130	84	142
77	149	71	155	69	157	112	117	110	105	121	134	92	148	78
52	174	64	162	70	156	111	113	115	106	120	98	128	86	140
181	45	180	46	186	40	116	109	114	122	104	132	94	146	80
53	173	66	160	163	154	37	167	39	29	36	194	193	24	202
178	48	163	63	72	58	189	59	187	195	192	30	35	20	206
55	171	169	158	38	161	44	159	62	32	33	197	190	200	26
176	50	68	57	188	65	182	67	164	196	191	31	34	199	27
184	165	41	172	43	170	47	146	49	21	204	23	25	207	198
61	42	185	54	183	56	179	80	177	205	22	203	201	28	19

Fig. 8.

207; that is just eighteen normal couplets to each. For S. W. 9-square the numbers 37 to 72 and 154 to 189; for N. E. 73 to 108 and 118 to 153; for the middle square, 109 to 117. Figs. 9 and 10 show the method of construction. The nine middle terms are first arranged as a 3-square, and around this are placed by a well-known process (Andrews, p. 47) eight normal couplets 101 +125 etc. forming a border and making a 5-square. By a similar process this is enlarged to a 7-square, and this again to a 9-square, Fig. 9. Each of these concentric, or bordered, or overlapping squares is magic by itself. The twin square N. E. is made by the same process with

the same 3-square as nucleus. In order to bring this nucleus to the corner of each so that they may coalesce with a bond of union, both of the squares are turned inside out. That is, whole rows are carried from bottom to top and from left to right. Such transposition does not affect the value of any rectangular row, but it does affect the diagonals. In this case the corner numbers, 74, 138 and 152 become grouped around the other corner 88, each of the couplets having the same diagonal position as before. Thus we obtain a 7-square with double border or panel on the North and East, still magic. This 7-square may now be moved down and out a little, from the border so as to give room to place its bottom row above, and its left column to the right, and we have a 5-square with panels of four rows. Again we move a little down and out

74	153	83	151	85	149	87	147	88
145	90	137	97	135	99	133	100	81
144	131	102	125	107	123	108	95	82
76	130	121	112	117	110	105	96	150
142	92	120	111	113	115	106	134	84
78	128	104	116	109	114	122	98	148
140	94	118	101	119	103	124	132	86
80	126	89	129	91	127	93	136	146
138	73	143	75	141	77	139	79	152

Fig. 9.

1	223	4	221	219	10
220	11	18	212	211	6
8	213	210	12	17	215
224	14	15	215	208	2
9	214	209	13	16	217
216	3	222	5	7	225

Fig. 10.

leaving space for the bottom and left rows of the 5-square and thus the 3-square advances to the required position, and the four squares still overlap and retain all of their magical properties. The twin square S. W. passes through analogous transformation. The minor squares were first built up as bordered 4-s as shown in Fig. 10 and then the single border was changed to double panel on two sides, but they might have gone in without change to fill the corners of the main square. As all this work was done by the aid of movable numbered blocks the various operations were more simple and rapid than any verbal description can be. The 15-square (Fig. 8) as a whole has the constant $S = 1695$ in thirty rectangular rows and two diagonals, and possibly some other rows will give a correct result. If the double border of fifty-two normal couplets be re-

moved the remaining 11-square, 4-7-11 will be found made up of two 4-squares and two overlapping 7-squares with middle 3-square, all magic. Within this is a volunteer 7-square, of which we must not expect too much, but its six middle rows and two diagonals are correct, and the corner 2×2 blocks pertaining to the 4-squares although not composed of actual couplets have the value thereof, 224+228. However, without those blocks we have two overlapping 5-squares all right. By the way, these 4-squares have a very high degree of magic, like those shown in Fig. 6, with their 2-squares and 3-squares so curiously overlapping. Indeed, this recent study had its origin some years ago from observing these special features of the 4-square at its best state. The same traits were recognized in the 8's and other congeners; also some remarkable results found in the oddly-even squares when filled by current groups, as well as in the quartered squares, led gradually to the general scheme of overlapping squares as here presented. Other investigators may have been working consciously or unconsciously on similar lines, but perhaps not to a great extent. It will be observed that the sections of Fig. 8 have a resemblance to some curious modifications of the concentric square, devised by Mr. Frierson (Andrews, p. 183). This is not merely a chance coincidence, nor an imitation, but doubtless there was a suggestion of possibilities. Without raising any question of originality or priority of invention it may be claimed that here the purpose and the conditions of the combination were quite different, the materials more extensive, and the methods of construction probably not exactly the same.

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THE BAGPIPE NOT A HEBREW INSTRUMENT.

In the course of an interesting article on "Music in the Old Testament," written for *The Monist,* April, 1909, Professor Carl Heinrich Cornill, of Breslau, makes the following statement:[1]

"This '*ugab* is most probably the same as the bagpipe, which is of course a very primitive and widely spread instrument, familiar to us as the national instrument of the Scotch, and best known in continental Europe as the *pifferari* of Italy."

As a matter of fact, however, it is not possible to say what manner of musical instrument is referred to in the Old Testament

[1] C. H. Cornill, *loc. cit.,* p. 251.

under the name *'ūgāb*. The word occurs only four times.[2] Except in so far as it is defined as the name of a musical instrument, no consistent explanation is given by the mediæval commentators. Abraham di Porta Leone (1612), in the Shiltē-haggibbōrim, goes so far as to identify it with the *viola da gamba* of his own day, an identification which cannot, of course, be accepted, for the reason that the principle of bowed instruments was unknown to the Hebrews. To go back to an earlier source, it appears that nothing definite can be derived from the evidence of the Greek and Latin translations of the Bible,—the word being thus variously rendered:

Gen. iv. 21,	LXX	κιθάρα	Vulg.	*organum.*[3]
Job xxi. 12	"	ψαλμός	"	*organum.*
Job xxx. 31	"	ψαλμός	"	*organum.*
Ps. cl. 4,	"	ὄργανον	"	*organum.*

There is no evidence whatever that it was a bagpipe.

An explanation to this effect has, however, found its way into encyclopedias and commentaries. Its source has lately been traced[4] to a misunderstanding, complicated further by inaccurate references, of a note in Winer's *Realwörterbuch,*[5] that a Hebrew version of the Aramaic parts of the book of Daniel has in iii. 5 *'ūgāb* for *sūmpōnyāh.*[6] The date of this version which is found in a manuscript of 1327, is uncertain; it contains, beside other errors, the obvious mistranslation, *sabbeka = hālil,*[7] so that it is of doubtful value, to say the least.[8]

Of the meaning of *sūmpōnyāh,* in Daniel iii. 5, there is no doubt. It is the name of the bagpipe, and indeed the only name by which

[2] Gen. iv. 21; Job. xxi. 12; xxx. 31; Ps. cl. 4.

[3] The English A. V., following St. Jerome, has "organ," R. V. reads "pipe," following the Aramaic Targums, which render *'ūgāb* always by *'ābūbā,* "a pipe."

[4] G. F. Moore, in *Journal of Biblical Literature,* xxiv, part ii, 1905, pp. 169-171. The author has rendered a valuable service to the world of scholarship in tracing this misinterpretation to its source.

[5] G. B. Winer, *Biblisches Realwörterbuch,* Leipsic, 1849.

[6] Winer, *loc. cit.,* vol. ii, p. 123, *s. v.* "Musikalische Instrumente": (*a*) עוּגָב Gen. iv. 21; Hiob xxi. 12.a, nach den jüdischen Interpreten, Chald. und Hieron. die Sackpfeife, Dudelsack, und (b) סוּמְפֹנְיָה chald. Dan. iii. 5; x. 15, *συμφωνία.* Polyb. bei Athen. x. 439, wohl eben dasselbe, wie denn die hebr. Uebersetzung dafür עוּגָב hat.

[7] *Sabbeka, σαμβύκη,* a stringed instrument; *hālil,* a flute.

[8] The author has wisely excluded the four instruments mentioned in Daniel iii. 5, *kitharos, sabbeka, psantērin,* and *sūmpōnyāh,* from his discussion of ancient Hebrew music.

it is known in the Old Testament. The name is a loanword from the Greeks, who knew the bagpipe as *συμφωνία*,[9] and passed the word in this sense on to the Romans, by whom it has been transmitted to the Romance tongues. To-day *zampogna,* the Italian derivative, is the common word for bagpipe among the peasants of Italy,—the *pifferari,* who throng at Christmas time to the cities and play on their pipes (*pifferi*) and bagpipes (*zampogne*) before the street shrines of the Virgin. In Spain, Provence, Roumania, Greece and Hungary, the bagpipe is still called by names derived from *symphonia*—the Greek word has come back into the language in the form *τζαμπούρνα*.[10]

It is true that, with the exception of the Pan's pipe, found in the New World as well as the Old, scarcely any instrument has come into general usage over so wide an extent of territory as the bagpipe. The ancient Greeks knew it,[11] the emperor Nero counted bagpiping among his accomplishments.[12] There remains, however, no evidence that the Hebrews knew it previous to the time of Antiochus Epiphanes.

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CREDULITY, INCREDULITY, AND IMMORTALITY.

How much may be legitimately asserted as proved with regard to the relations of consciousness and matter? To simplify the question, let us, for the sake of argument, ignore all the claims of psychical research on behalf of the spiritualist hypothesis. Let us assume that we have absolutely no conclusive scientific evidence of the existence of consciousness apart from matter. Let us assume that, in every recorded instance, consciousness has invariably been found in association with matter. What then is our logical position? Is it proved that it is impossible for consciousness to exist apart from matter? Most emphatically not!

And yet, a discussion on Immortality* reveals the remarkable fact that three eminent persons, Professor Ernst Haeckel, famous

[9] Polybius XXVI, 1; XXX, 26. Cf. LXX, Dan. iii. 5; Luke xv. 25.

[10] See my article, Daniel iii. 5,—sūmpōnyāh,—in *Journal of Biblical Literature,* XXVII, part II, 1908, pp. 111-121.

[11] Aristophanes, *Acharnians,* 862-66.

[12] Suetonius, *Nero,* 54. Cf. Dio Chrysostom, *Orat.* LXXI, p. 381, Reiske.

* See *Open Court,* Vol. XIX, p. 363.

throughout the whole civilized world, Dr. Carus, the editor of a philosophic magazine and well known throughout the whole philosophic world, and Mr. Thaddeus B. Wakeman, who is, I think, a man of distinction among a certain class of American thinkers—have all three publicly and irrevocably committed themselves to the contrary proposition.

What is the explanation of this remarkable phenomenon? Incredulity! And what is incredulity but another form of credulity—equally damnable, and, in persons in such positions, equally disgraceful. Such language, perhaps, may appear to need some apology. I can only say that the occasion deserves it.

Credulity is an unreasonable readiness to believe that something *is*—to believe a positive proposition. Incredulity is an unreasonable tendency to believe that something *is not*—to believe a negative proposition—in popular language, to disbelieve. Both are equally far from the golden mean—calm, cold, clear, unprejudiced, rationalism. The credulous man is too ready to multiply causes—to call in new causes to explain phenomena that can be satisfactorily accounted for by those already admitted. The incredulous man, alarmed at the results of credulity, flies to the other extreme, and tries to get too much out of the most obvious and generally admitted causes. He flatly refuses to admit even the possibility of any but a certain limited few—those most in evidence. He exercises all his ingenuity to see how much in the way of results he can pile on to these. And in his craze for simplification, the final goal he has set himself, is to eliminate all but one—selected as his fancy may dictate.[1] This intellectual monstrosity, Dr. Carus has for ever stigmatized as "Henism." His abode we might perhaps rightly call "Gehenna." And it is with great pleasure that I testify that Dr. Carus has proved himself too good for such company. But he is too much in sympathy with Gehenna for all that.

One more instance, and not *quite* such a glaring one is provided in Mr. Abbott's "Strange Case," whose admitted strangeness makes it of value beyond comparison with all the other amusing tales with which he has been entertaining us—until that strangeness has been explained away.

The moral honesty with which Mr. Abbott has endeavored to be intellectually honest in his account is as evident as anything can be. But yet he has not succeeded. And still less has Dr. Carus in

[1] Whence we have the Idealism of Prof. Ward, the "Energetics" of Professor Ostwald, and the materialism of others.

his comments. Mr. Abbott's classification of the phenomena that he witnessed under the heads of (1) explicable and (2) unexplained is painstakingly fair and impartial. Yet he exhibits the same irrational prejudice in favor of what he is pleased to call "rational explanation," the same question—begging assumption that the spiritual hypothesis is necessarily the irrational explanation, as Dr. Carus. He quotes with approval Dr. Carus's saying that "when one stands before something that he cannot explain, he should not conclude that it is inexplicable, and attribute it to supernatural causes." The very use of the word "supernatural" here convicts them both of prejudice. All causes that fall outside *their* conception of the world are dubbed supernatural. If there are any such things as spirits, then they must he inherent parts of this universe, and are no more supernatural than are tables and chairs. And to say that to attribute phenomena to such causes is the same as to pronounce them inexplicable amounts to a tacit and utterly unwarranted assumption that such causes cannot possibly have any real existence. An irrational *a priori* conviction of the impossibility of the existence of certain causes is of course proof against any amount of evidence in favor of their existence. And if we go for ever refusing to consider the possibility of the existence of any but known causes, no matter how often we may come across phenomena which are not, as a matter of fact, satisfactorily accounted for by those causes—why then all investigation becomes a mere farce. And a judge who professes to sit in an open court while he has all the time a closed mind is guilty of the very worst kind of intellectual dishonesty, namely dishonesty that masquerades as honesty. Of course the dishonesty is unconscious—just as Dr. Carus (*vide* last para. of his comments) seems to imply that Mrs. Blake's was. But that only makes the moral debacle the more awful.

If astronomical investigations had always been conducted on Dr. Carus's principles, mankind would to this day be ignorant of the actual existence of the planets Neptune and Uranus, and of the fact of the velocity of light. When we stand in the presence of something that we cannot explain, it is every bit as immoral to persist that it must be explicable by known causes, as to jump to the conclusion that hitherto unknown causes must be called in. Of course it is always open to us, as Dr. Carus says, to "comfort ourselves" by the reflection that the phenomena could be explained on known causes, *if*—something or other. Note the unblushing irrational prejudice that stands confessed in those two words "comfort our-

selves." Our intellectual comfort is to be our guide. No doubts as to our own fallibility shall distress us, no disquieting thoughts that after all there may be causes not dreamt of in our philosophy, —facts that won't fit into our cut and dried scheme. But we cannot go on laying ghosts that way for ever. They will not put up with it. Unfortunately there always is that "if" in these apparently inexplicable cases. And as these cases have been going on multiplying for a good while now, there are not wanting many eminent scientific men who have come to the conclusion that it is time for the spiritual theory to rank as a working hypothesis. In the only notice that Dr. Carus has ever condescended to take of Mr. F. W. H. Myers either in *The Open Court* or *Monist*—a brief reference tacked on the end of some little note or book review in the miscellaneous matter at the end of an *Open Court,* which I have tried unsuccessfully to find again—Dr. Carus admits that Mr. Myers has done more in this direction than anybody else. But he characteristically adds that "even he cannot be said to have proved" the spiritual hypothesis. Dr. Carus could not bring himself to say that Mr. Myers had signally failed in his attempt. And so he "comforts himself" with the reflection that the hypothesis is still not proved. Why should this be a comfort to him any more than the other alternative? The honest way of stating such a case would have been to say that Mr. Myers had produced a great deal of evidence in favor of the hypothesis, and had done much to render it probable. Still this Scotch verdict of "not proven," into which Dr. Carus has betrayed himself in this single brief and passing allusion contrasts not unfavorably with the attitude of dogmatic denials of the possibility of the spiritual hypothesis—the attitude characteristic of Prof. Ernst Haeckel, and certainly endorsed by Dr. Carus and Mr. Wakeman, in the instance above quoted, in *The Open Court* for June 1905. And coupling this "not proven" together with several other slight indications, e. g., his admission of his need of "comfort," I am inclined to suspect in my own mind that Dr. Carus finds his intellectual position not quite as comfortable as he would have us believe. His ghosts are not quite as effectually laid as he would like. He has never scoffed; that is one thing. Therein is some hope of his redemption.

* * *

With regard to the general question of individual immortality, however, I must confess that my own interest has until lately been philosophic, rather than scientific. I have not troubled much to

weigh the direct scientific evidence that modern spiritualism claims to have discovered in these extraordinary phenomena; for the simple reason that it has always seemed to me superfluous to turn to such phenomena for proof of the spiritual hypothesis. The philosophic proof of that hypothesis has always appeared to me so overwhelming as to reduce to comparative insignificance the importance of scientifically demonstrable instances of the truth. And science for science's sake, independently of its argument that we have no direct scientific proof of the existence of an individual and therefore immortal soul, it has nevertheless always seemed to me that the truth of this existence is an inevitable inference from the common facts of daily life.

In the philosophic treatment of this subject, however, as in the scientific, the same deep prejudice is shown by the whole anti-spiritualist school. The philosophic argument is one that I have never yet seen fairly stated. The old-fashioned orthodox spiritualist school have had their apriorism well rubbed into them by the anti-spiritualists; but these latter, with Dr. Carus among them, are all deeply tarred with the same brush. It is an extraordinary thing that there is a large class of thinkers who are ready to believe anything, rather than that they have individual immortal souls; and they will commit the most flagrant mistakes in common logical calculations, rather than admit such a conclusion. In the *Monist* for January 1908, Dr. Carus was kind enough to publish one of my "overwhelming" philosophic arguments, in which I endeavored to show how the whole modern scientific school have blundered over the subject of human will in its relation to the conservation of energy, because of their obstinate refusal to admit the spiritual hypothesis. No feats of dialectic or argumentative contortions can ever make it possible that animal movements that are partly determined by consciousness can at the same time be entirely determined by mechanical antecedents. The anti-spiritualists, however, defy all logic in their effort to bolster up materialism. And each has a patent of his own for wriggling out of this awkward position. Dr. Carus, however, after describing his patent, unblushingly admits that the real ground of his objection to a theory of spiritual causation is his own prejudice in favor of what he calls "a truly consistent monistic view"—that is, an anti-spiritualistic one. The argument by which he seeks to uphold the old-fashioned materialist version of the conservation of energy, is one which is part and parcel of my own spiritualist version of that doctrine. Meanwhile, by way

of conclusion, I would like here to present him with another philosophical conclusion, from which, I must confess, I myself personally have never yet been able to discover any possibility of escape.

All true philosophy must, to my mind, be based upon one axiom and one only—namely that the universe has a meaning. Despite all its apparent inconsistencies and contradictions, we must believe, if we are not to be put to intellectual confusion, that it is really one harmonious whole. And our business as philosophers is simply to discover the system on which it is built—the key that shall explain it all. To assume that there is a system, and then to search for it.

Dr. Carus himself admits that a place must be found in our world-conception for the immortality of the soul. And he claims to have fitted in that doctrine to his philosophy—in short, to have wedded together spiritualism (or rather soul-ism) and materialism.[2] But he has not. His immortality is a spurious article. He has fitted it to his materialistic universe only by depriving it of all immortality except in name.

If his philosophy is true, then the fact remains, as he himself admits, that, one day, all life, all mind and soul, all consciousness, all thought, all noble aspirations toward the high, all struggles against lower ideals, all goodness, all sin, all sorrow and all joy,—all that makes man man, and that gives life any purpose or value—will be as completely wiped out and extinct in this world as if they had never existed. It may sound an unphilosophic remark; but I can only say that that, to my mind, is rank twaddle. What does it matter what any of us do or think! It will all be the same a million years hence. Why not bore a big hole to the center of the earth and put in a billion tons of dynamite, and have done with it all for ever, *now*. It might be argued that if we can make sure of a million years of soul-survival, that ought to be enough to content us. But what is a million years, or what is time at all?! In the affairs of the universe, a million years is much the same thing as five minutes. What possible purpose could there be in for ever bringing worlds into existence like that, one after the other,—just to wipe them out again? I live for you, and you for me, and you and I live for posterity, and they for some other posteriority—and so on. And one day there won't be any posterity. What then?

[2] By materialism I mean simply anti-spiritualism, a conception of the universe which denies spirit. I quite understand and sympathize with Dr. Carus's reasons for repudiating the charge of materialism.

What, I ask, is the value of life itself, as life? And you can only reply—NONE! You admit that and you say you are satisfied. Continued individual existence has no attraction for you. Of course not—if you have drugged your soul to make it fit into your little picture of life. No one would want a continuous existence such as that of this present human race chained here to this earth. But do no possibilities beyond that rise in one's mind—no wider life sharing in the life of the universe itself? My soul does not belong to here and now—it belongs to God.

And God! your God! a big machine, devoid of consciousness. You are very much impressed with the "wonderful"-ness of consciousness. If it fills you so with wonder, I should suspect that after all it does not fit quite so comfortably into your little universe—the little shoes you have made for it. You try to account for it. It is a fact—undeniable. It is wonderful. It is the fabric of the soul. It is not a substance, nor a permanent existence, nor an entity. It originates and disappears (creation out of nothing—no—beg pardon —consciousness *is* nothing). The fact remains, however, that this queer thing is the greatest thing in the world. And yet, (1) one day it will be gone for ever! and (2) it is not in God! I can only say—If I have nothing greater than myself to loop up to and depend on, if the material soul-less world is my father and my God, then woe is me, and woe is the world! I am left face to face with a fathomless pessimism.

I know that Dr. Carus would say that even the material world is not absolutely soul-less—that all matter has a subjectivity of a sort. And that soul has in some mysterious way grown out of this subjectivity of matter—that the substance of the world is not, in any department of it, absolutely inanimate. But be that as it may, it makes no difference to the burden of my complaint. Relatively to us the material world is inanimate and soul-less. In the spiritual aspect of it, it is beneath us. The first beginnings of soul are necessarily inferior to its climax. And it is an uncomfortable position for an aspiring soul to find itself in—at the top, with no infinitely greater beyond to aspire to. That has ever been the complaint of the spiritualist against evolution. Evolution is a truth; but it is not the whole truth. It requires what spiritualists call "involution" to complete it—that is, the descent of the infinite, the perfect, into the finite—the incarnation of God. The finite soul could never have evolved unless the perfect soul had existed in the infinite. Soul is the highest thing in us. And we search in God for all that is

highest in ourselves—only, in God, it must be on a still higher scale —not on a lower. Of course God's consciousness cannot be ours. It is ours with the condition of infinity added to it—that is, it is unconditioned, infinite, transcendental. What it actually is like, we can hardly describe. Because it has no like. It is unique. We can only say of it that it is something that corresponds on the infinite scale to our consciousness on the finite scale. It is that from which finite consciousness can be evolved. It needs, perhaps, the subtlety of a German to help us out here. Kant tells us that God's consciousness is free from the limitations of space and time; and that therefore it is not thinking. He calls it "primitive intuition."[8] Dr. Carus says that God is super-personal. So do I. But this is my idea of super-personality. I think Dr. Carus ought to come round to it without much difficulty. I should rejoice if he could.

W. E. Ayton Wilkinson.

Burma, India.

THE OLD AND THE NEW.

IN REPLY TO MR. W. E. AYTON WILKINSON.

Among our subscribers of long standing, there has scarcely been a more careful and faithful, and (we must add) more critical reader than Mr. W. E. Ayton Wilkinson, of Thanatpin Burma, in distant India. He was critical because he did not agree with our editorial position which he regarded as rank materialism, he himself being a spiritualist, not of the crude and credulous kind that seek comfort in the seances of mediums, but a thinker who endeavored to base his conviction upon a philosophical foundation. We have exchanged many letters, and several articles of his have appeared in *The Monist,* all of them attacking the editorial views as to the nature of the soul, of consciousness, and of immortality. They were all thoughtful and presented arguments worthy of consideration and answer.

Though personally a stranger, his letters have exhibited a warm friendship, and he lived in the hope of converting us to his views. The last contribution from his pen appears in the current number and we regret to add with great sorrow, that while his article was standing in type and before we sent him proofs, we received the unexpected news of his death.

[8] I do not know German myself; and Mahaffy's and Bernard's Kant is the only edition I have.

I may be permitted to add a few personal remarks. Mr. Wilkinson knew me sufficiently to be certain that I would not hesitate to publish his criticism and he said exactly what he meant. He is impatiently severe and it is greatly to be regretted that he cannot see his article in print and feel the satisfaction of having had his say in all its vigor and directness. I must confess that while reading the manuscript I enjoyed his outspoken expressions which are the more noteworthy as they come from a kind heart. He has always manifested an unusual sympathy for me whom he regarded as the most dangerous opponent of his deeply cherished convictions.

We know little of Mr. Wilkinson's personal affairs, except that he was a mechanical engineer and a thoughtful student of psychology. He took a great interest in the labors of the Society for Psychical Research of England, and always regarded it as an unpardonable negligence on our part that we did not devote more space to their proceedings and other publications. Why we have not done so ought to have been obvious to him, who himself lays more stress upon philosophical reasons than upon scattered facts, or, as he calls them, "scientifically demonstrable arguments of the truth."

Mr. Wilkinson is mistaken, however, when he imagines that I have neglected to consider the methods and results of the S. P. R. I have said little about their work because I have no reason to hinder their investigations, or to dampen the zeal of those well intentioned (but in my opinion strangely mistaken) seekers after truth. The fact is that I have not discovered much that is worth mentioning. The results are all of a negative character which, if they prove anything, indicate that their method is futile. Still I wait for further developments and will not hesitate to call attention to anything that would seem of importance to me.

Mr. Wilkinson is further mistaken in thinking that I have not reviewed Mr. Frederic H. Myers's voluminous work on *Human Personality: Its Survival After Bodily Death.* In addition to the comment from which Mr. Wilkinson quotes, it was reviewed in *The Open Court,* May 19, 1903 (Vol. XVII, p. 308 f.). Moreover I have discussed somewhat at length the experiments made by Professors James and Hyslop with Mrs. Piper and can say only that they are typical of a large number of trance phenomena, so called. They prove nothing more than does Mr. Abbott's "Strange Case" which is interesting only because so much has been made of it by Psychical Researchers; but which I consider (and so does Mr. Abbott) as much of a failure as all the work of the S. P. R.

Now when considering Mr. Wilkinson's strictures, I find that aside from some vigorous protests made in strong language, he offers no tenable arguments whatever, and it is characteristic of him that the ultimate basis of his views is not reached by thought but by sentiment. He is a pragmatist. He believes because he has the will to believe. His psycholgy has its roots in his attitude toward the world as a whole, and his philosophy is not of an intellectual nature. Attitudes can be neither refuted nor proved; they are subjective.

In the present case, far from rejecting Mr. Wilkinson's attitude, I am inclined to recommend it. I had the same attitude and also the same mode of adjusting my philosophy to it in my younger years, and my present attitude is merely the result of broadening and adapting myself to a deeper insight into the nature of things.

Mr. Wilkinson says:

> "All true philosophy must, to my mind, be based upon one axiom and one only—namely that the universe has a meaning. Despite all its apparent inconsistencies and contradictions, we must believe, if we are not to be put to intellectual confusion, that it is really one harmonious whole. And our business as philosophers is simply to discover the system on which it is built—the key that shall explain it all. To assume that there is a system, and then to search for it."

I am prepared to go a step further than Mr. Wilkinson. To me it is not an axiom but a demonstrable truth that the universe is "one harmonious whole" and I have always insisted that "the universe has a meaning." The order of the world (which appears most obviously in the so-called laws of nature) constitutes a system. This system can be traced by science, and furnishes the basis of ethics as well as of religion. Without it could exist neither science, art, morality, nor any of our ideals. It is much more than a mere logical proposition, it is an objective norm; it is the condition of all order, all harmony, the possibility of human personality and of all the grand aspirations which adorn it and make man's existence valuable. In a word, it is what religion calls "God."

Now the difficulty which besets Mr. Wilkinson consists exactly in this: he clings to the symbol or allegory under which this ultimate foundation of the dignity of our existence is conceived. Otherwise we agree. With him I would say, "My soul does not belong here or now; it belongs to God."

Our lives are transient. Every action of ours, every joy, every sorrow, every event be it good or bad, sinful or virtuous, passes by,

and though its traces will linger, the time will come when this whole earth will be no more and we shall be as if we never had been. But the value of our lives does not lie in the number of years, nor is it on the other hand impaired by shortness. Our lives are to be measured by quality of life rather than by quantity of time, and Mr. Wilkinson is quite right when he says, "What is a million years? What is time itself in the life of the universe? A million years is much the same thing as five minutes."

What gives worth to our lives is not quantity but quality, and the quality that elevates us is exactly the eternal background of which we are, or ought to be, the incarnation. Buddha calls the divinity after which we all aspire, the Dhamma, and expresses it thus in some stanzas of the Dhammapada:

"If one should live an hundred years,
Ignorant. discomposed,
Better to him were life one day
Intelligent, enrapt.

"If one should live an hundred years,
Inert and weak of will,
Better to him were life one day
Exerting will-power strong.

"If one should live an hundred years,
Not seeing the highest Doctrine,
Better to him were life one day
When seeing the highest Doctrine."

Mr. Wilkinson says in criticism of my views, "What possible purpose could there be in forever bringing worlds into existence one after another, just to wipe them out again? I live for you and you live for me, and you and I live for posterity and they for some other posteriority and so on. And one day there won't be any posterity and what then? What, I ask, is the value of life as life, and you can only reply, NONE."

Mr. Wilkinson forgets that the background of all life which he calls the system of the whole and which I fully recognize, is to all practical extent identical with what in monotheistic religions is called God. It is true enough that I live for you and you live for me and we both live for posterity, and that our interests are mutually balanced so that no one lives for himself alone. The center of gravity lies outside of us, and the farther away it lies from any person the better it is. Woe to him who tries to have the center of his existence in his own puny little self. Egotism is not a system

which recommends itself. It will never satisfy our heart's desire and will leave us as empty as a bubble. When its race is run it will burst and leave nothing behind. It is exactly the significance of its interconnections which gives value to life and makes life's purpose endure.

But we must not forget that all the play of human activities with their mutually balanced interests between you and me and others would be mere nonentities were they not understood to be the surface only of that unfathomable ocean of life which is God, the eternal world-order, the norm of All-Being, the standard of right and wrong, the origin and prototype of our highest ideals, and the final goal to which we return. This unfathomable ocean of which we are the mere surface billows is not a nonentity. Though it is not a bodily or material existence, it is the quintessence of our lives and has been felt to be such by mankind since the most primitive beginnings of civilization. Here lies the root of all religions and I recognize the omnipresence of this eternal norm even though I would reject as mere allegories the definitions and symbols in which myths and dogmas express it.

In the sense of this God-conception, we must read the meaning of our own personal existence. Though there is no individual self, such as Mr. Wilkinson hankers after, I do not hesitate to say that man's soul is an actuality and its significance extends as far as its interests, its sympathies, its comprehensions will reach. Our souls are built up of our ideals, our sympathies and our interests, and as they manifest themselves in our labors and aspirations they are not limited to our bodily existence. Our souls extend wherever our influence goes and so they will live

> "Or ever the silver cord be loosed,
> Or the golden bowl be broken,
> Or the pitcher be broken at the well,
> Or the wheel broken at the cistern.
>
> "And the dust return to the earth,
> As it was;
> And the spirit return unto God
> Who gave it." *

Spiritualists, even those who like Mr. Wilkinson are thinkers, are practically materialists. They cling to the symbol and forget its significance. They overrate the part which consciousness plays, and overlook the fact that the main feature of the soul consists in its

* Eccl. xii. 6.

thinking, not in its feeling, its sentiency, nor in whatever else belongs to the senses. Consciousness is needed for thinking. It is an instrument but not an end. It is the concentration of feeling (of sense activity) upon one point to which our attention for some or any reason is to be directed. The final purpose of it is to throw light upon the path of life so as to enable us to take the right step and advance in the right direction. Consciousness serves as a searchlight which illumines the field of vision, but is as such transient and secondary. Its main purpose is to gain insight and to discover the truth.

Mr. Wilkinson is a typical representative of many serious people who seek the truth, who know by intuition the significance of religious truths, who know especially that the soul is worth more to us than anything in the world. The soul is we ourselves and the Biblical saying remains true, "What doth it profit a man if he gain the whole world and lose his own soul?" Mr. Wilkinson feels that the great religious truths of the dignity of the soul, of immortality, of moral ideals, would slip away from him if he gave up his soul-conception, and he is so accustomed to the one in which he has been educated that my broader view appears to him purely negative, and I do not think it would have been possible for him to see the deeper meaning of my conception of God, soul, and world though it is perhaps much nearer to his own than he could comprehend. I myself, passed through a long period of despair in which I thought that unless God was exactly as I had pictured him in my childhood, there was no God at all; and if immortality was not exactly the immortality which Christian mythology pictures, it would not and could not afford us comfort. But the world is deeper than we have thought. God is greater than dogmatic religion represents Him to be; our souls are still linked with eternity and before us opens a vista of infinitude.

EDITOR.

BOOK REVIEWS AND NOTES.

ANTI-PRAGMATISME. Examen des droits respectifs de l'aristocratie intellectuelle et de la démocratie sociale, par *Albert Schinz,* professeur à l'université de Bryn Mawr. Paris: Alcan, 1909. Pp. 301. Price 5 fr.

The first part is a refutation of pragmatism. The problem is reduced to a dilemma: Either the pragmatic method (of judging ideas and theories from their results and not from their own rational value, from their "cash value" as James says, and not from their objective value) is the same as the scientific method, in which case there is no need of a new philosophy; or it is not the same and does not agree with the scientific method, in which case it is *not* scientific. Now, as there can be no thought as to the existence of a pragmatic philosophy (one need only watch the formidable literature on the subject) pragmatism is something *not* scientific. What is it? It consists in reducing philosophy in general to ethical philosophy; in subordinating philosophy to moral purposes. Pragmatism means a return to the age of scholasticism: *Philosophia, ancilla theologiae* said the Middle Ages, *Philosophia, ancilla ethicae* says Pragmatism; Philosophy a "servant" in both cases. The fallacy on which Pragmatic method rests is exposed in book I, pp. 26-37. The pragmatic paradox has been expressed several times since scholasticism; by Pascal ("The heart has its reasons which reason knows not of"), by Rousseau who taught his pupil to use always the criterion of the "useful," and asked the pragmatic question, "What is it good for?" by Kant who claims the rights of "practical reason" as being above those of "pure reason"—i. e., always submitting objective truth to moral postulates or requirements.

The second part asks why, if pragmatism is so weak philosophically, does it have so many followers? Pragmatism must be explained as a special product of modern civilization, or modern preoccupations which are more freely developed in America than elsewhere, hence the fact that pragmatism is especially flourishing in America. In our days of democracy, philosophic ideas are no longer discussed among the chosen few, but by everybody, by the masses; the result is that philosophy is no longer free to express truths which might be dangerous for the masses (see pp. 98-104 for this fundamental development). Philosophy must express only useful, moral, pragmatic truth, even though truth itself lie in an opposite direction; truth must be good, useful. Pragmatism is nothing but this adulterated philosophy; philosophy sold to democracy. Two beliefs are necessary in ages like ours: belief in free-will to stimulate energies; and belief in God's moral government of the world, so as to restrain man from the religion of success. Pragmatism will fight any philosophy, any science, any idea that goes against these two fundamental dogmas.

The third part develops the thesis that pragmatism is good and therefore ought to triumph because it is *not* true; for truth is discouraging from the moral point of view because it is *not* amiable. Thus, it is good to keep the masses from objective truth, and tell them to believe in something else. Pragmat*ism* is good; but pragmat*ists* are deceiving us when they say that pragmatism and philosophy or science agree, for they do not. Pragmatists are right when they advocate pragmatism for the masses, but they are wrong when they claim that pragmatism is objective truth. There is only one way of straightening out matters: let us say that there are two truths, one for the masses and one for the scholar. This attitude would be wrong only if we philosophers were responsible for the fact that real truth is sad, and bad; but we are not; and therefore we will show our humanity, in telling people to believe (the following are James's words): "that which is good for them to believe." (A practical application of the system of two truths to literature is found in Appendix B: "Literature and the Moral Code.")

ALLGEMEINE GESCHICHTE DER PHILOSOPHIE. Von *Dr. Paul Deussen.* Vol. II, Part 3. Leipsic: F. A. Brockhaus. 1908. Pp. 728. Price M. 18.

We have now before us the third part of the first volume of this great work on the "General History of Philosophy" written with particular reference to religion. The whole of the first volume is devoted entirely to the history of India, and this division treats of the post-Vedic philosophy of the Hindus. It contains also an appendix to the philosophy of the Chinese and Japanese. In this appendix the author discusses China in general, giving a particular chapter each to Confucius and Lao Tze, following with a history of the development of Chinese philosophy and its three religions. He passes rapidly over ancient Japan and Shinto, Buddhism in Japan, and neo-Confucianism. The "Post-Vedic Philosophy" as a whole discusses first the philosophy of the epic period of India, then Buddhism, and finally the various minor philosophical systems of India.

RÉCRÉATIONS MATHÉMATIQUES, et Problèmes des temps anciens et modernes. By *W. Rouse Ball.* Paris: A. Hermann, 1907. 2 vol. Price, 5 fr. each.

It is only one additional tribute to the well-known value of W. Rouse Ball's *Mathematical Recreations* that a second edition of its French translation has appeared. This translation was made from the fourth English edition and has been somewhat enlarged by the translator, J. Fitz-Patrick. The final addition is a note by the publisher, Mr. A. Hermann, on the "Accounts of a person who spends more than his income; a method for establishing a life annuity." In this an attempt is made to show how three common difficulties may be conciliated, that is to say how the income may be increased while care must be taken not to deprive the heirs in case of premature death, and at the same time to safeguard a sufficient income in case a long life is attained.

ABRISS DER ALGEBRA DER LOGIK. Von *Dr. Eugen Müller.* Part I. Complete in three parts. Leipsic: Teubner, 1909.

Since Boole wrote his learned book on *The Laws of Thought* a new science has originated which lies on the borderland of mathematics and logic, and contains the most abstract thought. The most prominent thinker in

modern times who has built up this new realm is the late Dr. Ernst Schroeder, professor of mathematics at the Polytechnic school at Karlsruhe in Baden. He wrote a voluminous book on *The Algebra of Logic* and his main rival in this field of most abstract thought is the American scholar Charles S. Peirce, who uses the term "the logic of relatives." Since Professor Schroeder's death, Dr. Eugen Müller of Constance has been in charge of his manuscripts, and he has undertaken to condense the great work of Schroeder into small compass so as to make the main principles of the new science accessible to those who would not have the time to wade through the books of Boole and of Schroeder. He condenses Schroeder's *Algebra of Logic* into about 150 pages, which is to appear in three installments, the first of which, comprising 50 pages lies now before us.

THE NEW SCHAFF HERZOG ENCYCLOPEDIA OF RELIGIOUS KNOWLEDGE. Edited by *Samuel Macauley Jackson, DD., LL.D.* (Editor in Chief), *Charles C. Sherman, Geo. W. Gilmore,* and others. Vol. III, Chamier—Draendorf. New York: Funk & Wagnalls, 1908-1909. Pp. 500. Price, per vol., cloth $5.00; per set $60 to $108.

We are glad to welcome the third volume of this valuable work. It is the expectation of the publishers to continue issuing a new volume from the press every three months until the work shall be complete in twelve volumes. The present volume is of very especial interest as will be clear to any one who considers the possibilities of the initial letter C. Charlemagne, Christ, Christian, Christology, Church, Confession, Confirmation, Constantine, Councils, Creation, Creed, Cross, Crucifixion and Crusades are a few suggestive titles, bringing many others in their train, and all are treated with the same special thoroughness that characterizes the management of the work as a whole. The usual bibliographies are supplied at the end of each item and the volume contains a supplemental bibliographical appendix which brings the list of books covering the topics from Vol. I to the end of Vol. II down to January, 1909, thus placing the latest published information available at the disposal of the reader.

THE PLACE OF ANIMALS IN HUMAN THOUGHT. By *Countess Evelyn Martinengo Cesaresco.* London: Fisher Unwin, 1909. Pp. 376. Price, 12s. 6d. net.

To the lover of animals this book will open up a new field of interest. It is the result of the thought and investigation of several years on the part of the author, to whom the study and compilation has been a labor of love. A suggestion of Count Goblet d'Alviella at the Oxford Congress of the History of Religions last September, to the effect that the psychology of animals might have some bearing on the science of religions, confirmed Countess Martinengo-Cesaresco in her belief in the importance of animal psychology. Her discussion treats of the views of the various nations of the earth on the subject, under the following headings: Soul-Wandering as It Concerns Animals, The Greek Conception of Animals, Animals at Rome, Plutarch the Humane, Man and His Brother, The Faith of Iran, Zoroastrian Zoology, A Religion of Ruth, Lines from the Adi Granth, The Hebrew Conception of Animals, "A People Like Unto You," The Friend of the Creature, Versi-

pelles, The Horse as Hero, Animals in Eastern Fiction, The Growth of Modern Ideas About Animals.

A valuable feature of the work consists in the illustrations which have been gleaned from widely divergent and often recondite sources, and represent Egyptian, Assyrian, Grecian, Roman, Iranian, Arabian, Hebrew, Buddhistic and also prehistoric conceptions of animals. Orpheus and St. Francis are of course named among "The Friends of the Creature," and Hubert Van Eyck's painting of St. Jerome extracting a thorn from the paw of a lion is one of the interesting illustrations reproduced. The frontispiece to the volume is a photogravure from a tempera painting from Abul Fazl's *Akbar Namah,* now in the India Museum, and represents the Emperor Akbar personally directing the tying-up of a wild elephant. Unfortunately a cursory search does not reveal in the text any mention of Akbar's clemency and fondness for animals and his efforts to improve the various breeds, especially of horses and elephants. A similar incident to the one illustrated in Countess Martinengo-Cesaresco's frontispiece is graphically described in Dr. Richard von Garbe's *Akbar, Emperor of India,* reprinted in pamphlet form from *The Monist* of April, 1909.

L'ANNÉE BIOLOGIQUE. Comptes rendus annuels des travaux de biologie générale. Publiés sous la direction de *Yves Delage.* 10me année, 1905. Paris: Le Soudier, 1908. Pp. 500.

This important annual has changed its arrangement to some extent with this issue, in so far as its editors have thought best to omit the general review, more or less extensive, which has customarily preceded the volume as a whole, and they now limit themselves to a short notice indicating certain main points upon which biologists are concentrating their attention, and the principal works that bear upon these subjects. In its table of contents this volume gives a list of the "general reviews" included in all the preceding numbers.

AIDS TO WORSHIP. By *Malcolm Quin.* Newcastle-On-Tyne: T. M. Grierson. Pp. 182. Price, One Shilling net.

The secondary title "An Essay Towards the Positive Preservation and Development of Catholicism" is somewhat equivocal since it does not also define the author's point of view with regard to Catholicism. He states more clearly in the preface that he might have described the work as "An Essay on the Religious Interpretation of Auguste Comte" which would certainly have defined the scope and purpose of the work much more definitely, and would have been a guide to the reader as to the direction in which his further perusal of the book would lead him. A third of the volume is devoted to the introduction, and the "Aids" themselves have for a motto the verse, "Ye therefore shall be perfect as your Heavenly Father is perfect."

The book is really a manual of study and religious training for the Positivistic Religion of Humanity, founded by Comte, and the different subjects treated are discussed in terse dogmatic paragraphs with marginal headings, such as The Purpose of Worship, Perfection and Goodness, The Perfect Being, The Mystery of Evil, The Mystery of Human Freedom, The Humanity of God, The Paternity of God, God the Son, The Christ of Worship, The

Inheritance of Religious Speech, the Commemoration of Christ, The Divine Presence in the Eucharist, Commemoration of non-Christian humanity, The Universal Scriptures, Worship a Good in Itself, and many other similar topics. The same author has published a book of *Offices of Public Worship* for congregations of the Religion of Humanity.

Der Skeptizismus in der Philosophie und seine Ueberwindung. Von *Raoul Richter.* Leipsic: Dürr, 1908. Pp. 584, Price, 8 m. 50.

Now we have the second volume of this exhaustive work of Professor Richter, and this volume comprises the second, third, and fourth parts of the first book. The study of skepticism is taken up chronologically, beginning with the period of the Renaissance, which represents naturalistic skepticism, the most conspicuous exponents of which are Montaigne and Charron; then follows the empirical skepticism of the 18th century and a discussion of the relation between modern philosophy and skepticism from Bacon to Leibnitz, including Descartes, Spinoza, Locke and Berkeley and giving special attention to an exposition and critique of the skepticism of Hume.

The fourth part discusses the biological skepticism of the 19th century, first from Hume to Hegel, including a section on positivism, followed by a chapter on the life and teachings of Nietzsche. The first book treats of total skepticism (*der totale Skeptizismus*). The second book is announced at the end of this volume and will treat of *Der partielle Skeptizismus.*

Sociologie de l'action. Par *Eugène de Roberty.* Paris: Alcan, 1908. Pp. 355. Price, 7 fr. 50.

The latest contribution of Professor De Roberty's many works on sociology is the present discussion of the sociology of action, which he treats in two divisions; first the social genesis of reason, and second, the rational sources of action. In this volume he continues to emphasize his opposition to the timidity and equivocations of contemporaneous sociological thought, which was one of his principal objects in his former works on the "Constitution of Ethics" and the "New Program of Sociology." He feels the necessity of this very strongly, and he regards it as a more important fact in the realm of knowledge than in that of action, that not to advance means to retrograde.

Zur Wiedergeburt des Idealismus. Von *Jakob Schmidt.* Leipsic: Dürr, 1908. Pp. 325. Price 6 m.

These studies have grown out of a struggle on behalf of idealism against the modern idols of "psychologism, historism and positivism." A few of the titles of the fifteen studies here included are as follows: Capitalism and Protestantism; Mediæval Character of Ecclesiastical Protestantism; Theoretical Positivism; Harnack and the Resuscitation of Speculative Inquiry; Experience and Poetry; Goethe and Antiquity; Kant and Speculative Mathematics; The Education of Women, and Classical Antiquity.

Witelo, ein Philosoph und Naturforscher des xiii. Jahrhunderts. Von *Clemens Baeumker.* Münster: Aschendorff, 1908. Pp. 686. Price 22 m.

This work is Part II of the third volume of "Contributions to the History of Mediæval Philosophy," and contains the Latin text of Witelo's *Liber de*

Intelligentiis together with critical textual notes. This is followed by important philosophical excerpts from the philosopher's *Perspectiva.* Part II is the descriptive and critical portion of the work and after a biographical chapter discusses Witelo's smaller writings and the philosophy of the *de Intelligentiis* as well as its place in the history of philosophy. A short chapter is also given to the significance of *Perspectiva* in the history of philosophy.

LES ERREURS DE LA SCIENCE. Par *L. C. E. Vial.* Paris: Vial, 1908. Pp. 450. Price, 3 fr. 50.

This work is an exposition of a system of natural philosophy which attempts to unify all sciences by submitting them to the mechanical and contradictory principle of the "unit-couple," and to demonstrate by scientific testimony the part of man in creation, and the bond which unites him directly to the Creator, the life-principle and source of life. The first part deals in questions of mechanics and its relation to physiology proceeding likewise to the discussion of psychological questions. The second part deals with cosmic problems, defines the atom and describes the mechanism of electrolysis and radio-activity. It further discusses the nature of atmosphere, water, and earth and the parts they play in the author's cosmogonic conception.

COURNOT ET LA RENAISSANCE DU PROBABILISME AU XIX. SIÈCLE. Par *F. Mentré.* Paris: Rivière, 1908. Pp. 649. Price, 12 fr.

This work is recommended to the interest of the public both by the name of Cournot himself and the high value of the Library of Experimental Philosophy to which it belongs. The author here expounds the ruling ideas of Cournot's philosophy, his theory of order and chance, his "probabilistic" method, his philosophy of the sciences and his views on religion and ethics. The attempt has also been made to indicate the rise of these ideas and to characterize the range of their influence. The book is of a special value because Cournot's works have become inaccessible, and this volume contains the substance of his investigations.

Prof. C. J. Ball, of Oxford, has written a most learned and at the same time interesting article on "The Accadian Affinities of Chinese" in which he offers an irrefutable proof that the founders of the Babylonian civilization, the people of Sumer and Accad, furnished the materials from which the Chinese civilization has grown. He announces that his investigations will "convince the learned world of the truth of the theory that the Chinese writing had a Western origin, and that the Chinese language is the nearest living representative of the ancient Accadian. Already in 1871 Edkins could assert the probable consanguinity of the early Chinese with the 'Cushites' of Babylonia, and could state that 'many ancient customs point to a connection once existing between Western Asia and China.' That scholar, in fact, assumed, on the ground of resemblance in the principal elements of civilization, and altogether independently of the special considerations which are submitted in this paper, that the primitive Chinese were immigrants from the plain of the Euphrates, who entered their present country some five thousand years ago...

"Perhaps the first thing that strikes one in a comparison of the two

languages is the unusual number of common words. A few coincidences of sound would, of course, prove little or nothing, because such may be found in almost any pair of languages. The old Chinese *kot, kut,* is strangely like not only the Accadian *kud,* but also the English 'cut.' But while we may leave such correspondences, in cases where they are few and far between, to the diviners of the primeval speech, we can hardly do that in cases where the majority of words in both languages can be shown to be cognate or even identical. Number eliminates chance.

"Again, no argument for near kindred or identity can be based solely upon Accadian terms like *aba, ama,* as compared with the old Chinese *pa, ma,* 'father,' 'mother'; because such sounds may be paralleled from a multitude of tongues of every class and kind. The case, however, is different with such similarities as exist between the Accadian *sag* (*shag*), *zag,* 'head,' and the Chinese *sheu, sù*; between Acc. *shem, shab* (= *sham*), *shag, sha,* 'heart,' and Ch. *sǎm, sang*; between Acc. *shu,* 'hand,' and Ch. *sheu, shu.* Not much reflection is necessary to see that there must be a real connection between these common words, and that a fortuitous likeness of this kind is an improbable contingency. These coincidences, however, amount to hundreds, and practically exhaust the available vocabulary of Accadian."

Volume IV of the University of California Publications on Education consists of the second part of Milicent Washburn Shinn's *Notes on the Development of a Child,* treating in particular of "The Development of the Senses in the First Three Years of Children." The author's original data came from a journal of the development of a single child closely observed by her during the whole period of the record, but these data have been supplemented by the observations of others which in some points have become the basis of her conclusions more than her own record, because in these particulars her own notes were insufficient or because the facts had been already so well established that her particular observations could do little more than corroborate. Part One investigates the "Sensibility of the New Born" with regard to each of the senses; Part Two, the "Synthesis of Sense Experience"; Part Three, "Development in Discrimination and Interpretation."

It is customary at present to analyze the psychological disposition of philosophers, and religious leaders, and so a book by Jacob H. Kaplan on the *Psychology of Prophecy* (Philadelphia: Julius H. Greenstone, 1908), will be welcome. It is intended to be a study "of the prophetic mind as manifested by the ancient Hebrew prophets," the author being a Rabbi who handles his subject not only scientifically but also with reverence and discretion, and this makes the book more valuable.

Jonas Cohn, professor at the University of Freiberg, i. B., who has devoted much thought to the solution of the problem of infinitude, discusses in his recent book, *Voraussetzungen und Ziele des Erkennens* (Leipsic: Engelmann, 1908), the significance of logic as a basis of all philosophy. He proposes to expose the various fibers whch connect logic organically with the several parts of philosophy.

Vol. XIX. OCTOBER, 1909. No. 4.

THE MONIST

JEAN JACQUES ROUSSEAU, A FORERUNNER OF PRAGMATISM.

I DEFINE pragmatism as a philosophy that judges of the value of theories and ideas from their consequences, i. e., from the practical results which they yield to the thinker when he proceeds to apply them to reality.

Pragmatic results may be understood as scientific results; but in this case it becomes obvious that pragmatism is only another word for science, and hardly worth while to retain our attention. Of course we consider, and man has always considered, true or satisfactory, a law or an idea which yields results, and none else; and if a law or an idea explains nothing or accounts for nothing, it is given up. So this scientific pragmatism is not, cannot be, what pragmatists have in mind, for they would not have started a new philosophical school to say something that nobody ever denied, the very thing and the only thing which all scientific, philosophical, theological minds have always agreed upon since the dawn of conscious thinking. Of course William James says, "a new name for an old thing"; still we have too high an opinion of Professor James and others who followed him to believe that the "old thing" was the commonplace truth which the world has owned so long, and which science in our epoch is applying so frantically everywhere. Or else, one might just as well start a new

system of astronomy to prove that the sun shines at noon and remains invisible at night.

There is only one alternative: if pragmatic results do not mean *scientific* results, they must mean practical results from the point of view of "practical reason" as opposed to "pure reason," in other words, ethical results. And if this is what pragmatism means, then everybody will grant that there is something relatively new in it, in so far as there was never before so bold an attempt to reduce philosophy to moral philosophy; or, I should rather say, that never an attempt could appear so bold, as we live in a scientific era when scientific results alone are strictly recognized by scholars, while ethical or esthetic preoccupations are considered among them as intruding elements.

So the whole quarrel about pragmatism originates from the vagueness of the word "result," or "practical value"; the pragmatists endeavoring to make modern philosophy adopt ethical pragmatism instead of scientific pragmatism; and as they are entirely different things, as they are in fact incompatible things, scholars resist the attempt.[1] With this conception also the word of James, "a new name for an old thing," gets a very satisfactory meaning; namely, that man has always been inclined to judge philosophical theories from their ethical results. Pragmatism is only the philosophy which tries to establish this conception of things on a systematic basis, to justify this natural inclination.

It is of this ethical pragmatism—the only one which has a clear and distinct meaning—that Rousseau is a forerunner.[2]

[1] See the writer's *Anti-pragmatisme* (Paris, 1909) pp. 26-37.

[2] The words *pragmatisme*, or *pragmatique*, are of course not to be found in Rousseau. In *Nouvelle Heloïse* (II, 5) he speaks of Julie's father saying: "*Sa fille lui est moins chère que la Pragmatique*"; but here the political act of Charles VI of Austria is meant by which (1713) this emperor assured the throne to Marie-Thérèse as his successor.

I.

It might be interesting, and I think very relevant, to point out first a remarkable symmetry in the philosophical evolution of Rousseau and James, the latter being by far the chief representative of pragmatism; there can be no doubt that without him the movement would have been still-born.

We observe that both thinkers came to pragmatic ideas after a period of enthusiasm for pure science. James began by studying natural sciences; he took an M. D., and at first taught anatomy at Harvard University. Then he went over to psychology and wrote his most famous work, and finally he produced his pragmatistic papers and books. These facts can be interpreted thus: When he began to look at things for himself and reflect on them, James was at first interested in the universe in a purely objective way; he looked at it as a product which he liked to study in a perfectly impersonal manner. Then, secondly, he saw that the world was still more interesting when viewed from a human standpoint, from the psychological standpoint—moreover man cannot view it from any other point of view, absolute truth is outside of our means of perception; then he wrote his great work, *Psychology*. And third he came to the conclusion that man had an interest in the world not only from a human, in the sense of a psychological, standpoint, but from an ethical, or may be religious standpoint, as well. Man does not only study life, he lives it, he has a practical interest in it; then he wrote *Pragmatism*.

Rousseau's philosophical evolution describes exactly the same curve. Everybody remembers in the *Confessions* what he tells of his reading in mathematics, physics, chemistry and so forth, when living with Madame de Warens;[3]

[3] See especially Book VI. Cf. also Ritter: *Famille et jeunesse de J. J. Rousseau*, pp. 219 ff.

and especially the delightful scene when he is accused of necromancy by passers-by who see him in a garden at midnight studying astronomy in grotesque attire, moving a telescope backward and forward with mysterious gestures, and stretched out before, or rather under, a map of the sky illuminated by the weird light of a candle standing in a flower pot;[4] or the account of how he nearly blinded himself for life by careless handling of chemical substances in an unfortunate attempt to manufacture *"encre de sympathie"*;[5] or again when he tells himself so charmingly (always in the *Confessions*) that his famous *polype au coeur* which disappeared so miraculously before he came near the doctor, when a pretty woman appeared on the scene,[6] was nothing but the result of overstudy of books on anatomy, physiology and medicine; for, like the famous Dutch physician he could not read the description of a disease without at once feeling perfectly satisfied that he was suffering from it. Finally I need not insist on Rousseau's fondness for botany which first developed at that period also.[7]

Rousseau did not teach sciences, as Professor James, but he made use of his knowledge in mathematics as a member of the staff entrusted by Charles Emanuel III with the survey of the kingdom of Savoy. He also wrote in Chambéry in 1738, and published in the *Mercure de France* of July, a *"Mémoire sur la sphéricité de la terre."* Better still, Rousseau wrote in Paris, probably about 1747, a treatise on chemistry in four parts, *Les institutions chymiques,* the manuscripts of which can be seen since 1904 at the city library in Geneva.

[4] *Œuvres,* VIII, 171-2.

[5] *Œuvres,* VIII, 155. That the rumor spread of Rousseau's experiments, see Ritter, *Famille et jeunesse de J. J. Rousseau* (1896), p. 221.

[6] *Œuvres, VIII,* pp. 177-8: "...Voilà Mme. de Larnage qui m'entreprend; et adieu le pauvre Jean-Jacques, ou plutôt adieu le fièvre, les vapeurs, le polype...."

[7] *Œuvres,* VIII, p. 128.

II.

The second period of Rousseau's philosophical development corresponds to that in which James wrote his *Psychology*. Now, we must remember that in his book James has given up the traditional treatment of the three faculties, sentiment, intelligence, will. He offers a sort of natural history of our mental faculties in connection with, or even taking as a basis, our sensations, hence the name of "experimental" or "physiological" psychology given to the modern science we all know.

This conception of things goes naturally as far back as the 18th century, to Locke's *Essay on Human Understanding*. Indeed we can almost say that the works of our great thinkers of the 19th century, like John Stuart Mill in his *Logic,* Taine in his *Intelligence,* Wundt, Spencer, James in their *Psychologies*, are but new additions, broader in some places, more consistent in others, of Locke's epoch-making book. As a matter of fact, nobody ever went so far in the direction of sensualism and materialism as does James in his well-known theory of emotions, according to which we do not weep because we are sad, but we are sad because we weep, the physical phenomenon not being the effect of the psychical one, but rather the reverse.

Rousseau, thanks in great part no doubt to his unsystematic education, was endowed with a very unprejudiced mind, and he did not hesitate to adopt those views which were held at the time only by a few progressive men; Locke's ideas on this particular subject soon became his own,[8] and we can easily see how they came to him. He tells us in the *Confessions* that in the years after his return from Venice to Paris (1744) he had become a great friend of

[8] He had already studied Locke at the Charmettes. See *Œuvres,* VIII, p. 169.

Condillac, then writing his famous books.[9] He calls him once *"un très grand métaphysicien."*[10] Although Rousseau never went as far as Condillac in the latter's *Traité des sensations* (1754), namely that the only origin of all our ideas is sensation alone, he shared entirely the views of the earlier *Essai sur l'origine des connaissances humaines* (1746), that there are no innate ideas and that our ideas, due to reflection, would never have developed without sensation—the Locke point of view. Rousseau remained true to those beliefs in the time of his mature philosophy; in *Emile*[11] for instance, and in the much later *Dialogues*[12] we find them again only slightly transformed. It would be quite interesting to point out the influence of those physiological-psychological views on Rousseau in several special works, especially in the *Essai sur l'origine des langues,* which was written under the inspiration of Condillac's ideas;[13] and in a book which has not been printed, the manuscript of it being probably lost for ever, *La morale sensitive ou le matérialisme du sage.*

Students of Rousseau, generally, ignore this work entirely, and it is pardonable as long as it is lost. But a great loss indeed it is, for surely no work could have given us a better insight into Rousseau's real mind, precisely because it belongs to a period of transition, when he is not yet completely the Rousseau of the *Nouvelle Héloïse* or of *Emile.* We would have seen there how he became the later Rousseau, while now we have to guess more or less. Fortunately the little bit we know about the book, we owe

[9] *Œuvres,* VIII, p. 246. Rousseau places this in the years 1747-49, but this must be a mistake since the book of Condillac mentioned by Rousseau was published in 1746.

[10] *Œuvres,* XII, p. 304; cf. II, 75.

[11] See Books I, II, III, *Œuvres,* II, e. g., pp. 32-33, 102, 188 etc.

[12] *Œuvres,* IX, 196.

[13] Cf. *Œuvres,* I, p. 93.

to Rousseau himself, and so the information may be relied upon.[14]

What was this book? Rousseau tells us that among the works he intended to write—and which later were given up—there was one which he hoped would prove truly useful to men. "We have noticed that in the course of their lives most men are unlike themselves and seem to be changed into beings entirely different. It was not indeed to prove so well known a thing that I proposed to write a book; I had a more important and newer purpose. It was to find out about the causes of those variations, and to study those which are dependent on us in order to show how they could be directed by ourselves in order to render us better and exert more control over our actions.... In probing myself, and in examining others as to the causes of those different dispositions I found that they depended in great part, on the preceding impressions of exterior objects, and that, modified constantly by our senses and by our organs, we were feeling, without knowing it, in our ideas, in our sentiments, in our actions even, the effect of those modifications. The striking and numerous observations which I had gathered were beyond discussion; and by their physical principles, they seemed to me fit to provide us with a physical régime which, adapted to circumstances, could place our souls in the conditions most favorable to virtue.... Climates, seasons, sounds, colors, darkness, light, elements[?], food, noise, silence, motion, rest, everything acts on our machine, and on our soul consequently..... I have however, worked little over that book, the title of which was *La morale sensitive ou le matérialisme du sage.* Distractions which I shall soon explain prevented me from devoting much time to it, and the

[14] There is an interesting problem of erudition in connection with the *Morale sensitive*; but the discussion of it belongs rather in a review for the history of literature. Suffice it to say that further information about the book is not attainable, at least now, and that all that is reliable goes back to what Rousseau says himself in the *Confessions.*

reader will know also what has become of my first draft...." This passage is from the ninth book of the *Confessions* (pp. 292-3). In book twelve (pp. 46-7) he tells of all sorts of papers that were stolen from the things he had left in care of Madame de Luxembourg at the time of his hasty flight to Switzerland, when the *Emile* had been condemned. Among the stolen papers was the manuscript of the *Morale sensitive,* and Rousseau suspects D'Alembert, who, as a friend of Madame de Luxembourg may have succeeded in seeing those manuscripts, perhaps by bribing some servant.[15] At that time Rousseau considered D'Alembert as one of his worst enemies, and comments thus: "I suppose that, deceived by the title of *La morale sensitive*, he thought he had discovered the outline of a real treatise of materialism, from which he would have taken an advantage against me that one might well imagine."[16]

One may well ask why Rousseau did not take up his work again. I think we can guess that, and the very note we have just quoted about D'Alembert could suggest a clue. Such a book was not only difficult to write, it might prove positively dangerous. For in conveying upon people the materialistic idea that the dispositions of our "soul" depended ultimately so much upon physical sensations, as comparatively very few (if any) of those are actually within our control, people might take that as an excuse for not reacting against the lower impulses of the flesh. Thus the book could be interpreted as an excuse for our weaknesses, instead of a remedy against them, and so would provide arms to the enemy, and throw one's own away.

[15] In a note (Vol. XII, p. 47) Rousseau explains that D'Alembert had plagiarized many of his articles before they were printed in the *Encyclopédie* (for the *Elémens de musique*).

[16] One feels inclined to reject such ungenerous suspicions. Still, after the book of Mrs. Macdonald which shows how really shamefully Rousseau was treated by some of his contemporaries, there is a possibility of truth. So, if we should ever get some parts of the *Morale sensitive* back, it might be in looking into D'Alembert. The search may be worth while—the writer not having at hand the books necessary for such an inquiry is obliged to confine himself to these indications.

Madame de Genlis would certainly not have been the only one to gather from Rousseau's notes the impression which Rousseau himself thought might be D'Alembert's. She reflects: "I never thought that virtue depended upon good digestion or on the temperature of the air, or that certain drinks could cure bad inclinations, and that it was possible to absorb morality, like tea, by infusion."[17]

The insurmountable difficulty is, of course, that there is absolutely no criterion to decide where to stop in admitting that physical conditions are responsible for our morality. You cannot at one moment step in and say: "Now I will be virtuous" without throwing over the whole theory. For, this sudden disposition depends precisely upon foregoing dispositions, and those form an endless chain. Suppose a meal is so made up as not to develop my lower passions; either I am responsible for the meal or another is. If another is, then it is clear that my temper is not in my own hands. If I am, then I must have been predisposed well in order to order the virtuous meal; so from antecedent to antecedent, we are bound to come to admit that we are no longer responsible for anything. The same holds of climate, wind, rest, noise, etc.... What can I do? There is no middle term: we are or we are not in control. You may leave the subject alone altogether,—which is very wise perhaps,—but if you take it up, then you must be logical.

Rousseau chose to say that the dispositions of our soul depend upon material conditions; the result is that he will tell us very interesting facts probably, but surely none very favorable to moralization. And the time came when he saw it himself, and therefore he dropped the book. I venture to say that if he had written it, he would have torn it to pieces afterwards.[18] The time when he was thinking

[17] *Préface à Alphonsine*, p. iii.

[18] The book Rousseau had in mind *has been written*; but a century later. Those who are interested to see what a consistent treatise of the sort may be-

of writing it indicates a period of unconscious hesitation between the scientific or psychological point of view, and the ethical or pragmatic. He was then just where James stood when he printed his *Psychology,* and which after a long discussion of the book is expressed for the French public by Marillier in the following terms: "The teleological character of the system is at first striking, and one must penetrate beyond the literal sense to notice that very often it is a selection of a mechanical character much rather than of an intentional choice that is meant. This W. James says clearly nowhere; perhaps not because he is not decided yet which one of the two conceptions he will make his own, but because he constantly goes from the one to the other without admitting it plainly." (*Revue philosophique,* Feb., 1893, p. 182,)

III.

James finally decided for a teleological system, or what is now often called—a new name for an old thing—pragmatism. I have shown elsewhere, in quoting texts, how pragmatic utterances had meant at first for James simply a set of rules for practical life, *independent* and really *outside* of philosophy, and how only gradually the idea came to him of introducing those merely practical advices into philosophy itself, and trying to subordinate intellectual and scientific principles to practical principles.[19] The result is that his philosophy now, pragmatic philosophy, is described by James himself in such sentences as: *"The 'true,' to put it very briefly, is only the expedient in the way of our thinking, just as the 'right' is only the expedient in the way of our behaving."* (*Pragmatism,* p. 222);[20] or "On prag-

come ought to read: Yves Guyot, *La morale,* Paris, 1883 (in the collection *Bibliothèque matérialiste*).

[19] A. Schinz, *Anti-pragmatisme,* Paris, 1909, pp. 52-54.

[20] What James says regarding this passage in the *Journal of Philosophy* of December, 1908, does not affect the case very much.

matic principles we cannot reject any hypothesis if consequences useful to life flow from it. . . . They [universal conceptions] have. . . . no meaning and no reality if they have no use. But if they have any use, they have that amount of meaning." (*Ibid.*, p. 273.) (Of course we must understand that in the second part of the quotation, James means also "useful *to life,*" as nothing indicates any change to "useful" in a merely scientific sense); or let us recall the pragmatic "question": "Grant an idea or belief to be true, what concrete difference will its being true make in any one's actual life?" (*Ibid.*, p. 200.) This is plainly making philosophy a servant to ethics. *Philosophia ancilla theologiae* was the definition of scholasticism; *Philosophia ancilla ethicae* is the definition of pragmatism.

Now let us see Rousseau reaching the same goal.

Exactly parallel to James's phrase: "On pragmatic principles, we cannot reject any hypothesis if consequences useful to life flow from it," is Rousseau's declaration at the end of his career, when he summarizes his philosophical and literary creed, and writes, speaking of himself (Second Dialogue[21]): "I have never seen him listen calmly to any theory that he believed harmful to the public weal." (Je ne l'ai jamais vu écouter de sang froid toute doctrine qu'il crût nuisible au bien public).

As was to be the case with William James one century and a half later, Rousseau had really never committed himself to a mechanical conception of life; he had only, for a while, used such language and studied problems in such a fashion that readers could hesitate as to his real opinion on those questions. So when he had once decided to publicly take a stand against such mechanical theories of life, he felt like dispelling any uncertainty in the public, and missed few occasions to come out openly against the materialism of his epoch. He did so repeatedly in his best-known

[21] *Œuvres*, IX, p. 194.

works. Let us take only one example, which is not so well known.

In 1758 he wanted to write a complete and systematic refutation of Helvetius's book *De l'esprit*. He finally gave it up, because the work in question was condemned by the censor shortly after its publication and the sale of it was prohibited.[22] But we have the marginal notes put by Rousseau to his edition of Helvetius's book, and they give us a very clear idea of what Rousseau wanted to prove. They are published in the *Œuvres complètes,* XII, pp. 296-304. Helvetius maintained that man is merely passive in his judgments, in his sentiments and actions. This irritated Rousseau and he refers finally to a refutation in the *Profession de foi du Vicaire savoyard.*[23]

To Helvetius who thinks that two (passive) faculties, sensation and memory, are sufficient to account for our whole mental activity, and that *comparer* and *juger* are merely other forms of sensation, Rousseau opposes that, already in comparison due to memory there is something more than mere passive sensation of difference; and as to the distinction between sensation and judgment, he expresses it thus:[24] "To perceive objects is sensation; to perceive relations is judgment" (*Apercevoir les objets c'est sentir, apercevoir les rapports c'est juger*).

The whole discussion is summed up and concluded in the *Profession de foi du Vicaire savoyard* as follows: "Thus

[22] *Œuvres,* III, 122.

[23] There is here again a small problem of erudition. We must believe that the notes on *De l'esprit* are made on the first edition, as Rousseau expressly states it in a letter (cf. *Œuvres,* Vol. IX, p. 418); but, as the first edition was of 1758, and the *Vicaire savoyard* is of 1761 or 1762, how could Rousseau refer in 1758 to a work published three or four years later (p. 304)? The whole problem of the relations of the *Profession de foi du Vicaire savoyard* and the *Réfutation du livre de l'esprit* will be examined by the writer elsewhere; let it suffice here to say that a solution is not impossible if one weighs carefully every word of Rousseau in XII, 304. No doubt Rousseau was at the time (1758) already busy with the *Profession de foi*; possibly a good part of it was more or less ready, and thus he could speak of it as of a work in existence although not yet before the eyes of the public.

[24] *Œuvres,* XII, p. 300.

I am not merely a sensitive and passive being, but an active and intelligent being, and no matter what philosophers say, I dare pretend to the honor of thinking. I know only that truth is in the things and not in my mind which judges them (*que la vérité est dans les choses et non pas dans mon esprit qui les juge*) and that the less I put of my own in my judgments about them, the surer I am to come near the truth: thus my rule, to listen to sentiment more than to reason, is supported by reason itself."

Why is Rousseau so much concerned with those theories?—The last passage quoted tells it plainly: if human judgment is merely passive, the same will be true of our emotions, of our wills which depend on our perceptions and judgments of things; if that were true, it would do away with moral freedom, and this would be very bad from an ethical point of view. That this is the attitude of Rousseau is shown in the second part of his refutation of Helvetius, one of his last remarks being: "In the first place uprightness is indispensable, and not intellect (*l'esprit*); and in the second place it depends upon us to be honest people, and not to be *gens d'esprit*" (XII, 304); it is shown abundently further in all his best known works.

Rousseau is determined to get a philosophy of an ethical nature, i. e., a philosophy which must be good *morally* for humanity, even at the expense of truth if need be; he will refuse to consider any other as he himself told us.[25] As a matter of fact, nature, life and therefore philosophy are neither moral nor immoral, they are indifferent, or as we say now a-moral; but I repeat it once more, this is just the distinctive character of pragmatism that it would force nature and life, and therefore philosophy, to be moral, or, as some say, teleological,—the latter term meaining again "morally" teleological, it goes without saying. Of course,

[25] *Œuvres*, IX, 194, quoted above, and cf. with James's *Will to Believe*, p. 126.

if nature, and therefore objective truth, on the one hand and morality on the other hand agreed with each other, philosophy would never have been anything else but pragmatic, it would be so naturally. But as they do not agree, a special philosophy, different from natural philosophy, was to be founded in order to carry through pragmatic, i. e., non-natural philosophical principles. Pragmatic philosophy is therefore, cannot be anything but, unobjective philosophy, superposed over objective philosophy.

On the other hand, all philosophy to be acceptable must look objective and natural, and so of course pragmatic philosophy will have to claim that it is natural philosophy. And as it is not it will have to try to make us believe that it is: therefore, *to create a confusion between a natural or objective philosophy, and a non-natural philosophy is the very aim pragmatic philosophers will have to pursue.* If they do not do it, if they do not conceal that natural philosophy and pragmatic philosophy do not naturally agree, their cause is lost.

Thus the success of pragmatic philosophers, like Rousseau and James, depends upon their cleverness to confuse things; and indeed they have made it hard for their opponents to disentangle the fallacies of pragmatism. Philosophers ought never to cut Gordian knots, let me try to untie smoothly Rousseau's knot. The whole matter is contained in the last passage quoted.

To reduce philosophy to pragmatic or moral philosophy, two things are necessary:

1. to prove that we are not mere automata, that we can be really moral, i. e., active.
2. to prove that our natural way of thinking is pragmatic or moral, not intellectual; that therefore moral thinking is not merely a special application of pure thinking, of rational thinking, but is thinking itself.

Thus, the two adversaries to be fought will be *sensualism* and *rationalism.*

First, Rousseau forms an alliance with rationalism to defeat sensualism, thus establishing that human beings actually think; that the way in which they think does not depend exclusively on the data of the senses.

Secondly, that once established, Rousseau suddenly turns against rationalism, and says that thinking is bad. He means, of course, mere thinking, thinking which is not "morally" colored. As morality is the goal, any thinking that is not "moral" is bad, therefore the less one thinks, i. e., thinks merely rationally, the better.

Let us now read over the little paragraph quoted and analyze it and see whether I have betrayed Rousseau's thought.

First he says: *"I dare pretend to the honor of thinking."*

But he adds immediately: *"I know only that truth is in the things and not in my mind which judges them, and that the less I put of my own in my judgments about them, the surer I am to come near the truth: thus my rule to listen to sentiment rather than to reason is supported by reason itself."*

The "only" between parts 1 and 2 is a very innocent looking word; as a matter of fact, there is the most remarkable opposition between the two statements connected by it.

The first says: I think; I am not only passive but active in my judgments; I must think, otherwise I am not free and there is no morality possible.

The second says: The more I think, the further away I go from truth; I must *not* think, otherwise I get away from sound moral thinking.

Thus: *first,* I must think (to be free); *second,* I must not think (to be right).

There seems to be another contradiction in Rousseau's

attitude towards sensualism and rationalism. Regarding the first he said: Let us not admit that we are passive in our judgments; and regarding the second: Let us rather be passive in our judgments. But never mind the paradox. What he is aiming at all the time, is plainly indicated by the last sentence of the little paragraph under consideration where he opposes *sentiment* to *reason*. He means that we ought not to be affected by intellectual or rational judgments; we must not think intellectually. In other words *he admits the existence of other judgments, besides intellectual judgments.*

What are those other judgments, suddenly and surreptitiously thrown in the discussion?—Well, the sentimental judgments, which Rousseau seems to avoid to name, are the moral or pragmatic judgments. But why this fear of speaking plainly, of expressing openly the principles which are at the bottom of his whole philosophy and of momentous works like *Emile* and all the others? Simply because Rousseau felt very well that this move, of the admission of different sorts of judgments, though clever for his purpose, could not stand the test of critical examination. To judge, which implies to think, cannot *not* be intellectual, and so either to think and judge morally is one and the same thing as to think or judge intellectually, or it is not; and then to judge morally is to judge non-intellectually or irrationally (or a-rationally, that makes no difference.) Now, as Rousseau plainly suggests two kinds of judgments, (*a*) sentimental and (*b*) rational or intellectual, there is no way out of it, the sentimental must not be rational. There would be no use distinguishing them if they were alike.

We come now to the next question. As Rousseau puts those irrational judgments at the basis of his philosophy, refers to them all the time, they must of course correspond to something definite. What is it? What is *practical reason* as opposed to *pure reason* (—for, this is the oppo-

sition which Rousseau establishes and which Kant named so conveniently)?—Back of this famous word, *practical reason*, lies the whole secret of the pragmatic fallacy.

When you judge or think, you always judge intellectually or rationally, there is no escape from that; but it is possible when judging intellectually to judge either objectively or subjectively; and now we see at once how "practical reason" can still remain "reason." You have pure reason and applied reason, pure philosophy and applied philosophy, as you have pure science and applied science. As a mathematician gives up pure mathematics for astronomy, or a chemist gives up pure chemistry for confection of food, or a physicist gives up pure physics to manufacture telephones, so one can give up pure philosophy for applied philosophy, the most common form of which is ethics. It is still intellectual, but what was the end before, to study and to judge man, nature, life for the sake of pure science, for the sake of promoting objective truth, has become a means, i. e., one applies judgment or thought about men, nature, life to the promoting of happiness, of social order, of morality—no matter how you call it. And this applied judgment, this intellectual judgment in favor of a special end, an ethical end, is the sentimental judgment of Rousseau, or, as he calls it, simply sentiment, meaning of course moral sentiment, or moral sense.

As a matter of fact Rousseau and later pragmatism have done nothing else but to say, and try to make us believe, that this applied moral philosophy was really philosophy itself and that whatever is not moral philosophy (or does not lead to it directly or indirectly; religion e. g. in a pragmatic sense is "moral" too) is not true philosophy. But this is as if an astronomer said that of mathematics only so much is true as can be applied to astronomy; or if a food manufacturer claimed that only that much of chemistry is true which applies to "Force" or "Quaker Oats";

or if a capitalist owning a street-car line maintained that physics is true only in so far as it can move his cars along.

Keeping in mind then that "sentiment" or sentimental judgment of Rousseau is nothing else than a special application of philosophy or pure reason to ethics, let us read in its more explicit form the little sentence ending our paragraph; only two adjectives have to be supplied to betray the fallacy in logic: "My rule, to allow myself to be guided by sentiment rather than by [pure] reason is confirmed by [practical] reason itself"; or, as we have seen that the second "reason," practical reason, is the same as "sentiment," we will have: "my rule. . . . to be guided by sentiment rather than by reason, is confirmed by sentiment (itself)"—which of course is just the opposite of the conclusion Rousseau wishes to reach; and moreover, a very transparent *petitio principii*; as if a father were going to prove his authority over his children by saying: this authority is proven because I say so. The word *itself* is absolutely illegitimate, and suggests to the reader a confusion which he could not possibly have committed if clear terms had been used, if "reason" was used consistently, and not at first as *pure* reason, and then as *practical* reason.

The fallacies just exposed are better recognizable in Dewey than in James and Rousseau. Dewey naively attempted an elaborate and painful identification of purely philosophical principles and pragmatic principles on logical grounds; I have shown in the *Journal of Philosophy* (of Nov. 16, 1908) why it was *a priori* impossible that he should succeed, and how in insisting upon logic in pragmatism, he was carried to the antipodes of pragmatism in spite of himself. James and Rousseau wisely did not insist on that part of the matter; Rousseau, as has just been seen, managed to get the whole thing in an innocent looking little bit of a paragraph where probably not one of a thousand readers will notice it—a real trick of legerdemain

(done, I need not say, with a very generous and moral purpose in view, a *pieux mensonge* as they say in Rousseau's country). James is as wise as Rousseau; he kept silent. Only once have I noticed that he faced the difficulty, and then the honesty of the man betrayed the attempts of the philosopher: for he implicitly admits that there is really no logical, no rational background to that aspect of pragmatism. This important passage is found in *Pragmatism,* when James feels cornered by an objection to pragmatic views, which he cannot help mentioning, namely: what has the teleological element to do with truth? "The essence of a sane mind, you may say, is to take shorter views, and to feel no concern about such chimeras as the latter end of the world. *Well, I can only say that if you say this you do injustice to human nature.*[26] Religious melancholy is not disposed of by a simple flourish of the word insanity. The absolute things, the last things, the overlapping things, are the truly philosophic concerns. . . ." (p. 108). Nobody says that you must ignore those "absolute. . . last. . . overlapping things," or even that they are not more important to humanity than merely objective philosophy. But the true philosopher considers that one ought not to call objective philosophy what is merely our subjective power of reasoning.

Another passage of James may be quoted here as proof of how much the same preoccupations are at the bottom of both philosophies. I need only recall the fact that what Rousseau called sensualism is now called materialism, and what Rousseau called rationalism is now called agnosticism. Keeping this in mind read James: "Just as, within the limits of theism, some kinds [of theisms] are surviving others by reason of their greater practical rationality[!], so theism itself, by reason of its practical rationality is certain to survive all lower creeds. Materialism and agnosti-

[26] The italics are mine.

cism, even were they true, could never gain universal and popular acceptance, for they both alike give a solution of things which is irrational to the practical third of our nature ["sentimental" third of Rousseau], and in which we can never volitionally feel at home." (*The Will to Believe,* p. 126.)

For both Rousseau and James the whole problem of philosophy consists in this: identify truthfulness[27] and usefulness: you can say of a truth "either that 'it is useful because it is true,' or that 'it is true because it is useful' "; and the "usefulness" meant there is pragmatic or ethical "truthfulness," not merely "objective" or "scientific": "On pragmatic principles we can not reject any hypothesis if consequences useful to life flow from it." (*Pragm.,* p. 273; cf. 222, 233 and 234, and the whole of lectures VII and VIII.)

This *ethical* meaning is the meaning of the pragmatic "question": "Grant an idea or a belief to be true, what concrete difference will its being true make in anyone's actual life?"—or there is none.

And notice that we find this famous "pragmatic question formulated in remarkably similar terms by Rousseau. It is expressed or understood everywhere in his writings; but probably nowhere so plainly stated as in the third book of *Emile.*

In the programme laid out by him for the education of the boy, Rousseau proposes for the two first periods, from one to five, and from five to twelve years of age, a merely physical and animal development; the body and mind of the child must be let free, he must get strong and ready for work. Only when he is twelve years of age, shall Emile begin to apply his acquired strength and faculties to some definite purposes. The time has come to teach him. What shall one teach him? There are three, or rather

[27] I do not see that it makes much difference to say *truth* or *truthfulness*; still as James insists in a special article (*Journal of Philosophy,* March 26, 1908) on that distinction I gladly insert "truthfulness."

four sorts of things, which man can learn: some are false, some useless, some proper only to develop our vanity. There are a few, however, which are worthy of a wise man: "The question is not to know what is, but only to know what is useful." (*Il ne s'agit pas de savoir ce qui est, mais seulement ce qui est utile.*) *A quoi cela est-il bon?* (What is it good for?) that, from now on, is the sacred word....the one you teach, as being his most important lesson, to desire to know nothing except the useful, ask questions like Socrates. Let me quote the few lines with which Rousseau sums up his whole book of *Emile*: "It is enough that the child should know the 'what for' (*l'à quoi bon*) of everything he does, and the 'why' of everything he believes. Once more: *my purpose is not to give him science, but to teach him how to get it in case of need, to make him appreciate it for exactly what it is worth, and to make him love truth above all.*"[28] (P. 179.)—How clear it is here that "truth" means "practical truth," "cash-value," as James says, *in opposition to* "science"!

All this, I say, is good pragmatism.

When it comes to special application of pragmatic principles the comparison holds of course. But as Rousseau has worked out the application more than the principles and James has done the reverse, it will suffice to refer the reader to the second half of the *Nouvelle Heloïse* where applications follow upon applications under Rousseau's pen. See particularly Part V, Letter 3. One instance, however, may be allowed here: the views of Rousseau and James about religion. I have treated this point at length regarding James in my book *Antipragmatisme*, p. 143 ff. I recall only one passage of *Pragmatism*: *"If theological ideas prove to have a value for concrete life, they will be true, for pragmatism, in the sense of being true for so*

[28] The italics are mine.

much."[29] Now here are two short sentences (from among hundreds) showing how Rousseau applied the pragmatic principle one and a half century ago, principles which, when applied, look much less sublime than when vested in the eloquent sentences of the *Profession de foi du Vicaire savoyard*; even here the grand style of Rousseau has dazzled most of his readers. A few years had elapsed since Saint Preux and Julie had yielded to their love; now Julie is married to Wolmar, but Saint Preux lives under the same roof as preceptor of their children. Wolmar goes away and the two former lovers remain alone: "Our hearts," writes Saint Preux, "had loved each other; they had not forgotten; and everything now seemed to unite in making us sin again." Julie was determined, however, to conquer, and "she could not imagine a more reliable precaution than to impose upon herself constantly a witness whom she would have to respect, to call, as a third one among us, the integer and redoutable Judge who sees secret actions and reads our hearts. She surrounded herself with His supreme majesty; I saw God constantly between her and me. What guilty desire could have attempted to ignore such protection?"[30]

And on the same page again, discussing the case of Wolmar who was good without religion, Rousseau puts in Saint Preux's mouth the following words: "Milord, we will never be able to convert that man; he is too cold, and he is good; the question is not to touch him [with arguments]; he lacks the interior proof of sentiment, and this is the only one which renders the others irresistible," in other words: Wolmar needs no religion, being good without it; therefore we have no way of converting him. And here

[29] James underlines.—It is true that he adds: "*For how much they are true, will depend entirely on their relations to the other truths, that also have to be acknowledged,*" but it is evident that this contradicts the first sentence flatly. If the ideas are true anyway, what is the use of pragmatism; if pragmatic ideas have the first right to be called truth, why bother about other criterions?

[30] *Œuvres*, IV, p. 416.

remember James's words in the *Will to Believe,* p. 30: "The whole defense of religion hinges upon action. If the action required or inspired by the religious hypothesis is in no way different from that dictated by the naturalistic hypothesis, then religious faith is a pure superfluity, better pruned away, and controversy about its legitimacy is a piece of idle trifling, unworthy of serious minds."[31] Rousseau said: "And if the Great Being did not exist....it would still be well that man should think of him [*s'en occupât*] constantly, so as to remain better in control of himself, to be stronger, happier and wiser." (*Œuvres,* IV, p. 248.)

To sum up my whole demonstration of the parallelism of Rousseau's and James's thought, I offer the two following passages for comparison. In them, for every one who has in the least a critical sense, these two thinkers give themselves away (if I may so speak) in their attempts at pragmatizing philosophy. These two passages allow us to put our finger right on the spot where the system leaks, or, still better, go off on a tangent.

James writes in *Pragmatism,* pp. 76-77:

"If there be any life that it is really better we should lead, and if there should be any idea, which, if believed in, would help us to lead that life, then it would be really *better for us* to believe in that idea, unless, indeed, belief in it incidentally clashed with other great vital benefits. [Now listen:] 'What would be better for us to believe'! This sounds very like a definition of truth. It comes very near saying 'what we *ought* to believe': and in *that* definition none of you would find any oddity. Ought we ever not to believe what it is *better for us* to believe? And can we then keep the notion of what is better for us, and what is true for us permanently apart?" That playing with the

[31] It is true that Wolmar is not actually presented to us as sharing the "naturalistic hypothesis," but that is of no importance here; any thing that is not the "religious hypothesis" may be understood as well.

logical and the sentimental meaning of *ought,* I call the superlative of cleverness.[32]

Now to Rousseau. It is a passage from the answer to the archbishop of Paris (*Œuvres,* III, pp. 92-93), who had written his "Mandement" aginst *Emile,* speaking especially of the *Profession de foi du Vicaire savoyard.*

"It appears to me credible that, after these long periods lost in puerile controversies, men of sense will some day seek for a means of conciliation. The first thing they will propose will be to put out of the assembly all theologians [you might read just as well metaphysicians or philosophers]. This good work done, they will say to the peoples: 'So long as you do not agree upon any common principle, it is impossible for you to understand each other; and it is an argument that has never convinced any one, to say I am right and you are wrong. You speak of what is agreeable to God, but that is precisely what is in question! If we knew which creed was most agreeable to Him, there would be no dispute between us. But you also speak of what is 'useful' to men—that is a different matter. Men can decide this. Let us take this utility for our rule, and then let us establish the doctrine which is nearest to it. We may by this means hope to approach as near to the truth as is possible to men; for *we may assume*[33] that what is most useful to the creatures of His hand, is most agreeable to the Creator."

Exactly the same fundamentally: the useful, in the sense of the morally good, must be the principle of belief, philosophic or religious. The only difference in expression being due to the circumstance in which the passages were written. Rousseau proves a trifle more theological because he answers de Beaumont who attacked his pragmatism on religious grounds, and he wants to show that religious

[32] The same has been done by Schiller. See *Anti-pragmatisme,* pp. 23-24.

[33] The italics are mine.

problems are far from indifferent to him; James, on the other hand, is facing philosophers and argues with the aim of turning logicans into moralists or pragmatists.

Of the two, James is altogether more philosophical. Rousseau thinks that he can oppose a systematic and rational philosophy to the objective philosophers on the one hand, and to the dogmatic Christians on the other, namely that in the world everything is rationally and morally harmonious (*Profession de foi du Vicaire savoyard*); while James is more modest and frankly acknowledges that pragmatism requires the giving up of the ideal of unity of thought. He plunges into *pluralism* because reality refuses to be synthetized in his philosophy: "The world is One just as far as we experience it to be concatenated, One by as many definite conjunctions as appear. But then also *not* One by just as many definite *dis*junctions as we find... It is neither a universe pure and simple, nor a multiverse pure and simple." (*Pragm.*, p. 148); and he advocates *meliorism* because he cannot be an *optimist*: "It is clear that pragmatism must incline towards meliorism...."Meliorism treats salvation as neither necessary nor impossible..." (p. 286). This modesty about the shortcomings of his own philosophy is extremely praiseworthy on James's part; only as it is equivalent to saying that pragmatism does not stand the scientific test of unity of thought, it is from a philosophic point of view, simply mortal.

Our task is really over here. Still it is interesting to remark how closely the two philosophers compare, when one examines some applications of the pragmatic principles which the two men have deemed important to discuss.

Three examples may be selected:

1. For both men the ultimate purpose of pragmatic principles is to fit people for practical life as much as possible, and thus increase their general happiness. Now the danger is that if you preach happiness outright people are

likely to indulge unwisely in pleasures and thus, either to burn the candle at both ends, or to get blasé to pleasure; in both cases it means depriving themselves ultimately of good things just out of sheer ignorance or heedlessness. There was at the time of Rousseau, and there exists undoubtedly to-day, a tendency among us to overwork ourselves, so to speak, in making merry, while for purely Epicurean reasons we really ought to refrain more. Thus, both Rousseau and James insist repeatedly in their writings on a sort of asceticism which men must impose on themselves, not at all to deprive themselves, but on the contrary to get *more* enjoyment out of life in the long run, or more power of resistance against suffering. From James I quote the passage of *Psychology*, Vol. I, pp. 126-7, which he has not unfrequently developed in later works, recently in a pedagogical publication. It is found at the end of the chapter on "Habit": "As a final practical maxim, relative to these habits of the will, we may then offer some thing like this: *Keep the faculty of effort alive in you by a little gratuitous exercise every day.* That is, be systematiclly ascetic or heroic in little, unnecessary point; do every day or two something for no other reason than that you would rather not do it, so that when the hour of dire need draws nigh, it may find you not unnerved and untrained to stand the test. Asceticism of this sort is like the insurance which a man pays on his house and goods. The tax does him no good at the time and possibly may never bring him a return. But if the fire *does* come, his having paid it will be his salvation from ruin. So with the man who has daily inured himself to habits of concentrated attention, energetic volition and self-denial in unnecessary things, he will stand like a tower when everything rocks around him and when his softer fellow-mortals are winnowed like chaff in the blast."

James here takes life under its severe aspect; let us select in Rousseau a few passages where the Epicurean note

is more pronounced. The author writes of the incomparable Julie: "The means she uses to give value to the smallest things is to refuse to take them twenty times, in order to enjoy them once." One of the ends she wishes to reach thus, is "to remain her own mistress, to force passions to obey, and to subordinate all her desires to the rule. It is a new way of being happy; for one enjoys without uneasiness only what one can lose without difficulty; and if true happiness belongs to the sage, it is because, of all men, he is the one from whom fortune can rob least" (*Œuvres* IV, pp. 378-9). Or again: "The privation which she imposes upon herself by this tempering voluptuousness (*cette volupté tempérante*) are both new means of pleasure, and new ways of economizing. For instance, she loves black coffee: at her mother's house she took some every day; she has given up the habit in order to get more taste for it. She has decided to have some only when guests are about, and in the salon d'Apollon, in order to add this little rejoicing to the others" (p. 286). At times it goes so far as to lack the sense of the beautiful: "When I tell her of the things they invent all the time in Paris to render the riding in carriages more comfortable, she approves of that well enough; but, when I tell her how far they have gone in improving the varnishes of the carriages, she follows me no more and will always ask, whether those beautiful varnishes will render the carriages more convenient" (p. 371).[34] Shall we say that the heroic "Roman virtues" so emphatically praised by Rousseau lose something of their lustre when brought back to that pragmatic standpoint?

2. In another point, we may call it the metaphysical meaning of life, James and Rousseau show rather striking similarity of thought. Both are anxious to secure for men the happiest and at the same time the healthiest way of living; and not only do they see that the practicing of 'vir-

[34] See also pp. 380, 384, 397 ff. etc.

tue' is by no means always accompanied by happiness, but also that people get at times impatient to wait until after death to settle their bills of rewards. So as our philosophers address everybody, and especially the masses, i. e., mostly more or less childlike people, they must find some sort of encouragement for them. They will then pat a man on the back and tell him not to be sulky at the unpleasantness of life, as we do our boys when they are reluctant to go to the dentist and we tell them: Now, you will be a good boy, you will not cry, you will be a real courageous boy. That is the meaning of James's theory of risk: man has the honor, the great honor of conquering evil, this is greatly preferable to just plain happiness; nobody would want that, would he? "Those Puritans who answered 'yes' to the question: Are you willing to be damned for God's glory? were in this objective[?] and magnanimous condition of mind" (*Pragm.*, p. 297).

Rousseau ends his *Profession de foi du Vicaire savoyard* with a few statements that remind us curiously of the last pages of *Pragmatism*: "Why is my soul dependent upon my senses and chained to this body which makes a servant of it and is a hindrance to it? I know nothing about it; did I enter into the secrets of God? But I can without impropriety propose modest suppositions. I say to myself: 'If man's mind had remained free and pure, what merit would there be to love and follow the order established in the universe and which he would have no advantage to trouble?' He would be happy, no doubt; but his happiness would not be of the most sublime kind which is the glory of virtue and a good conscience: he would be only like angels; and no doubt one day the virtuous man will count more than they do. United to a mortal body by bonds no less powerful than they are incomprehensible, the care for the conservation of this body incites the soul to refer everything to itself, and gives it an interest which

is contrary to the general order, which it can nevertheless see and love. Then it is that the good practice of his free-will becomes both merit and recompense, and that man prepares for himself an unalterable happiness in fighting against his terrestrial passions and keeping true to its first volition."[35] In a more solemn tone than James in his last lecture, this expresses very much the same thing: Man has a beautiful chance to be great, to conquer evil; he certainly would not forfeit the honor, the occasion of being a hero, of outdoing divine beings who simply cannot help being good. All this is simply taking man by his vanity so that he may not see the pettiness of his God; the ultimate purpose of the order of things not only is never made clear, but it is positively a stumbling block in a system which claims the rational God of Protestantism.[36]

3. The last rather striking similarity in the details of the two pragmatisms of Rousseau and James, which will be mentioned here is this: Both want men to be persuaded that there is a spiritual power above us, and they warn against the false claims of vain science. As indeed all superior beings in all times, they both have a deep sense for the mysteries that surround life, and will surround it even if we know a thousand times as much as we do now. In other words, both have a decided predisposition to mysticism. From James we have words like these appearing in *Will to Believe*: "The negative, the alogical is never wholly banished. Something—call it chance, freedom, spontaneity, the devil, what you will—is still wrong and other and outside and unincluded, from your point of view, even though you be the greatest philosopher" (p. viii). James has become a member of the Society for Psychical Research. In Rousseau one will not find the

[35] *Œuvres,* II, p. 264.

[36] Which at bottom is also James's. I have shown in my book how the God of Catholicism is more satisfying than the Protestant one. See *Anti-pragmatisme,* pp. 185-190.

theory expressed so plainly, because, as has been said above, he is not as philosophical a mind as James, not feeling the shortcomings of his system and thinking he can keep philosophical unity together with pragmatism. In a way, of course, his religion of "sentiment" is after all mysticism. But further we have a few very interesting facts showing that Rousseau was inclined to believe in certain kinds of *seconde vue* and in the realization of dreams. He experienced one illustration of *seconde vue* himself and told Bernardin de Saint Pierre about it. The latter relates the conversation as follows: "He firmly believed that Divinity had laws of action unknown to men. We were speaking of presentiment, striking dreams, and I quoted some to him. Then he told me: Once when I was in the age of innocence and purity, I was alone in the country, and I allowed my thought to wander freely until I finally completely lost consciousness of the landscape around me; and I saw a castle, avenues, hedges, a society of people whom I had never seen, but all so clearly, so distinctly alive that, filled with astonishment, I regained consciousness so struck with the picture that it remained profoundly impressed in my memory with all its details. Many years after I found myself in a castle with the same hedges, personages, figures, actions; and the whole so absolutely alike that I uttered a cry of surprise." (Pp. 102-103.) Now, if we open the *Nouvelle Héloïse* once more, which was to the end the favorite book of Rousseau, we find that he believed in dreams. In Part V, letter 9, St. Preux (Rousseau) sees Julie who comes herself to announce that she is going to die soon. Claire, hearing the dream (letter 10) is all upset; and a few pages further we hear of the accident that caused the young woman's death. Furthermore we have a passage where St. Preux, in spite of the theories which were expressed at the very same epoch in *Emile,* actually believes in the interference of God in the affairs of this

world to grant a prayer. In Book V, letter 6, Wolmar tells his wife that her prayers for his conversion would have been heard long ago if there had been a God, and in a sort of ecstasy Julie answers: "They will be heard....I know not the time and the occasion. Might I obtain this in paying for it with my life! My last day would then be the most useful." And here again the presentiment on the one hand is realized, and the prayer is granted.

* * *

How shall we account for two philosophers so much alike in their departure from objective truth and separated from each other by a century and a half?

The explanation is not far to seek. They both were men before being philosophers; they both cared for the welfare of humanity to such an extent that they could not remain impartial in their attitude towards plain truth as the latter seemed to point to another direction than the one they wanted, and which would always be in full agreement with human ethics. And each lived at a time when society was threatened by scientific theories which were dangerous for the equilibrium of sound moral life int he community: the 18th century was facing materialism; our epoch is facing agnosticism. Rousseau and James both felt that scientific truth was not good for all, that it could easily be misinterpreted byt he unprepared minds of the masses, and they proposed pragmatism, i. e., to subordinate philosophy to ethics, to identify truthfulness and usefulness. That the intention was generous, no thoughtful person can deny. Whether the method is commendable is another question; but it is not my intention to discuss this here. I would rather end by asking another question.

Are Rousseau and James themselves satisfied with their theories?

As far as James is concerned I have tried to answer in my book in the chapter called: "Is James a Pragmatist?"

Moreover I have discussed above his *pluralism* and *meliorism*; nobody wilfully admits that his philosophy lacks a principle of unity; James needed it in order to remain a pragmatist.

What about Rousseau? I doubt whether he was ever entirely convinced by his own philosophy.

As early as the time when he wrote his first "Discours" he realized the difficulty of his position (see the last pages of it): if science and art are really bad for civilization, bad morally for nations, then one ought to do away with them. Rousseau obstinately refuses to draw this conclusion; and after several attempts, to reconcile things, he gives this as his final theory: "When people are corrupted [as we are] it is better that they should be educated then not (*savant qu'ignorants*); when they are good it is to be feared that science will corrupt them" (Letter of July 15, 1768). Now this cannot be understood otherwise than: Prevent people from getting corrupt by allowing them to get objective truth, science and art; but once they *are* corrupt, it is better that they should corrupt themselves more....Of course Rousseau could not mean that.

Further, I should like to call attention to Rousseau's inconsistency, when he maintains that botany, which is a science also, ought not to be studied for merely practical purposes. At the end of his life especially he strongly objects to those who feel like asking the pragmatic question: *A quoi cela est-il bon?*, who study plants "only with the purpose of getting drugs and remedies." This "disgusting prejudice" is especially strong in France, he thinks: a *bel esprit* of Paris, seeing in London a public garden full of trees and rare plants, was "barbarous" enough to cry out "in matter of praise these words: 'Here is a beautiful garden for an apothecary!' " As to himself "all this pharmacy did not sully his enjoyment of the country."[37]

[37] *Œuvres*, IX, pp. 375-6.

Finally I refer the reader to the third *Réverie,* where in later years Rousseau discusses his own philosophy. Among other things he says: "I confess that I did not solve to my satisfaction all the difficulties which embarraassed me, and which philosophers constantly opposed to us. But determined to reach at least some decision in matters on which human intelligence has so little hold, and finding everywhere impenetrable mysteries and unsolvable objections, I adopted in every question the 'sentiment' which apepared to me best established by direct data. . . ." and so forth.[38]

One sees that there might be room for a chapter "Was Rousseau a Pragmatist?" corresponding to the one on James discussing the same question.

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[38] *Œuvres,* IX, pp. 342-343.

FERTILIZATION AND HYBRIDIZATION.[1]

[*English Translation by Prof. C. Stuart Gager, University of Missouri.*]

"Vom Vater hab' ich die Statur,
Des Lebens ernstes Führen,
Vom Mütterchen die Frohnatur
Und Lust zu fabuliren."[2]

IN these lines lies the whole problem of heredity and fertilization. What everybody can see, Goethe has voiced clearly and concisely in beautiful, simple words. We have one part from the father, the other from the mother. Or, as it is now usually put, the hereditary characters of the two parents are combined in the offspring.

It became the problem of scientific investigation to seek out the cause of this phenomenon. It could not be limited to man. The law mentioned by Goethe must be general, it must be true of the entire plant and animal world, wherever two beings unite for the production of progeny. Furthermore it cannot concern ordinary fertilizations only, but also those abnormal cases in which unlike individuals, belonging to different varieties or species, fertilize each

[1] The paper, read in Haarlem in the Dutch language, appears here in an enlarged form. My conception of the life-processes in the nuclei is chiefly based on the renowned investigations of van Beneden and of Boveri, as well as the most recent researches by Conklin (*Contr. Zool. Lab. Pennsylvania*, XII, 1902), Sutton (*Biol. Bull.* IV, Dec., 1902), Eisen, (*Journ. Morphol.* XVII, 1), Errera (*Revue Scientif.*, Feb., 1903), and of many others. For the literature I refer to E. B. Wilson, *The Cell in Development and Inheritance*, and V. Häcker, *Praxis und Theorie der Zellen- und Befruchtungslehre.*

My presentation of the processes of fertilization and hybridization is an outcome of the experiments which I have described in the second volume of my *Mutationstheorie* (Leipsic, Veit & Co., 1901-1903. English translation in preparation by Open Court Publishing Co.) H. DE V.

[2] Goethe, "Sprüche in Reimen," *Gesammelte Werke*, III, 83, 1871.

other. The products of such crosses we call hybrids, and for science they possess the great importance that, in them, the manner in which the characteristics of the parents are combined, can be studied more easily and clearly than in the children of a normal union. For, the more the parents differ from each other, with the greater certainty must it be possible to determine the share of each in the characteristics of the offspring.

Everywhere this law is confirmed, that the child inherits one part of its nature from the father, the other from the mother. The child is, therefore, on the whole, a double being, with twofold qualities, more or less distinctly separated, that may still be traced back to their origin. This *principle of duality,* as we might call it, dominates the entire theory of heredity; it forms the thread that binds together apparently separated cases; it serves as a guidance for the whole investigation.

This investigation occupies two different fields. On the one hand we have experimental research, on the other hand microscopical. Physiology ascertains the relations of the offspring to their parents; it analyzes their characteristics into their individual units, and tries to demonstrate their origin. The history of development discloses to us the corresponding microscopic processes; it looks for the smallest visible bearers of heredity in the cell, and investigates how they are maintained during life, and how, during fertilization, they pass on from father and mother to the offspring.

Few investigators master both provinces; their extent is much too great for that. And especially has the study of hybrids so greatly advanced in recent years, that even here a division of labor will soon be necessary. Both lines of work have therefore developed more or less independently of each other. In both, the main features of the problem begin gradually to arise out of the abundance of

individual phenomena. And thereby there is disclosed, one might almost say, beyond all expectation, an agreement in the results of both lines of investigation, which is so great, that almost everywhere the physiological processes are reflected in the microscopically visible changes.

It is true that the final analysis lies yet beyond the limits of our present microscopical vision. Compared with the enormous complexity of the hereditary characters of the organisms the anatomical structure of the cells and their nuclei, as it is known to us, is much too simple. The individual traits of father and mother can not yet be found in the cells of the offspring, but the investigations of most recent times indicate clearly that here also the limits of knowledge are being constantly extended.

The double nature of all beings that have sprung into existence through fertilization, is seen in their external appearance, as well as in the finest structure of their nuclei. The principle of duality obtains everywhere, even if, in individual cases, the demonstration of it is yet in its beginnings. But as far as the visible marks can be analyzed and the individual component parts of the nuclei can be traced, so far can the validity of the principle be proven even at present.

Let us consider first the external part, then the internal.

Goethe derived his stature from his father, and not from his mother, and it was not a stature between the two. The sum total of his qualities he had partly from his father, partly from his mother. The illustration explains the rule in a clear manner. In the offspring the characters of the parents are combined. Not always does the child get an even half from each; on the contrary, as everybody knows, it resembles the mother more in some respects, and the father more in others.

It is exactly the same with hybrids. With them a single character is generally derived either from the father or

from the mother. The hybrids of white and blue flowers usually bloom blue, those of a hairy or a thorny parent crossed by one without hairs or thorns are usually hairy or thorny. The crossing of a common evening-primrose with a large-flowered species results in a flower of the size of the former. But, if there are two or more points of difference they may be transmitted to the children partly by the one parent and partly by the other, and it is thereby possible in practice to combine the good characters of two varieties into a single race. Thus has Rimpau created a series of hybrid-races of wheat, and Lemoine has produced his large-blooming sword-lilies, able to withstand the winter, and thus have originated, in agriculture and horticulture, the countless hybrids, in which the favorable characteristics of various varieties are combined with more or less diversity. Combined, or as we usually say, mixed; though this is an expression which makes us only too easily lose sight of the independence of the individual factors in the mixture.

This independence is frequently difficult to demonstrate in the mixtures, that is, in the characteristics of the hybrids. Our means of differentiation only too frequently prove insufficient. In the clear cases, however, it appears very distinctly, and the greater the number of hybrids that are studied accurately and thoroughly, the more generally is the validity of the principle established.

If, for example, we find combined in a wheat-hybrid, the loose ear of the mother-plant, with the lack of awns in the father, the share of each appears simple and clear. In the mixture of the characteristics these two are so far apart, that they are always easily recognized. How are such characters united in the hybrid? Are they fused into one whole, or do they simply lie loosely side by side?

The splittings, which occur regularly in many hybrids, when propagated by seed, but also, in the case of a few, in

vegetative propagation, give us an answer to this question. Of the last kind the *Cytisus Adami* serves as the most beautiful and striking instance. It is a hybrid between *C. Laburnum* and *C. purpureus,* unfortunately its great significance for the main features of the whole problem has been underrated for a long time owing to the fable of its having originated as a graft. As a matter of fact no hybrids are obtained by grafting, no matter how great the mutual influence of the wild stock and the crown graft. As far as historical evidence goes, the *Cytisus Adami* has always been propagated by grafts since its first appearance, but it did not originally spring into existence in this way.

This tree teaches us how the qualities of the two parents are combined. Ordinarily they occur mixed, the leaves as well as the flowers having some features of the *Laburnum* and others of the *purpureus.* The totality of the characters lies, therefore midway between the two parents. But splittings do occur, and not at all rarely, or rather so commonly, that indeed every specimen of the hybrid, if not too small, will show them. In these splittings the types of father and mother separate sharply and completely. Some twigs will grow that are purely *Laburnum,* while others are only *purpureus.* The former are vigorous and long-lived, the latter remain weak and often die after a few years, which is the reason for their being seen less frequently. But even in this point they resemble exactly the respective parents.

Within the hybrid, the bearers of the parental characters are therefore arranged in such a manner that, so to speak, they can be completely separated, at any moment, by a simple cut. And, if not by a simple cut, then at least by a physiological splitting, which passes exactly between the two parental groups and does not leave in one of them any trace of the other.

In this manner we have to picture to ourselves, in a general way, the internal, invisible structure of the hybrids. The bearers of the characters of both parents are intimately connected, and together dominate the visible characteristics. But they are not, by any means, fused into a new indivisible entity. They form twins, but remain separable for life.

In all nature there is probably not another such beautiful instance of splitting as the above-mentioned *Cytisus*. But with lesser differences between the parents, splittings of the parental types occur frequently in the vegetative life of hybrids. Many horticultural plants, and especially the bulbous plants, furnish instances thereof; peas, corn, wood-sorrel, anagallis, oranges, and several others are known instances. The fruits that are half lemon and half orange, belong doubtless to this group. Among the hybrids of the common and the thornless thornapple (*Datura Stramonium*), individuals have been found, although very rarely, that showed a similar splitting, and which even bore on the same fruit, armed, as well as thornless cells. In my garden, I cultivated, for many years, a *Veronica longifolia* which was a hybrid from the blue species and the white variety, and correspondingly had blue flowers. But from time to time splittings occurred either one single spike bloomed white, or a few isolated white flowers appeared on an otherwise blue spike.

During the entire life, up to the time of the formation of the reproductive cells this internal dualism manifests itself in this way. Sometimes proofs of it are even found in the anatomical structure of the tissues, and of the individual cells, where the parental characters are set free and a mosaic-like structure results.

Macfarlane, who has made the most thorough study of the anatomical structure of hybrids, recognizes everywhere the principle of duality, and goes so far as to regard

every individual vegetative cell of a hybrid as a hermaphrodite formation. And the renowned French investigator of hybrids, Naudin, also expressed himself about forty years ago in a similar manner. *"L'hybride est une mosaique vivante,"* said he; we do not recognize the individual parts as long as they remain intimately blended, but occasionally they separate and then we are able to distinguish them.

We therefore regard it as established that, in the children, the inheritances from the fathers and mothers are indeed combined, but not fused into a new entity. Acting always conjointly under ordinary circumstances, they yet do not lose the power of separating occasionally.

But now arises the question as to what is anatomically visible of this union. Can the dualistic formation be observed within the cell? Do the parental inheritances, here too, lie side by side as twins?

The hereditary characters are contained in the nuclei, as was first declared by Haeckel, and later demonstrated by O. Hertwig, and, for plants, by Strasburger. This important law forms, for the present, the basis of the whole anatomical theory of heredity, and is recognized as such by all investigators. We may, therefore, expect to find in the nuclei, as well, the dualism of the parental qualities.

Every cell, as a rule, possesses a nucleus. This nucleus dominates the life-activity, and although the current functions can run their courses without it, no new ones can be introduced. In certain filamentous algæ (*Spirogyra*) Gerassimow succeeded in producing cells without nuclei; they retained life for several weeks, feeding vigorously, but nevertheless they always perished without any reproduction. In some tissue-cells the nucleus is constantly in motion, and according to Haberlandt's investigations, it stops longest where the work of the cell is most pronounced for

the time being, as for instance in unilateral growth, the formation of hair, local accumulation of chlorophyll etc.

This concentration of hereditary characters is most distinctly seen in the sexual cells. Here the other functions are reduced to a minimum. The nucleus dominates completely. In the male sperms the activity of the protoplasm is limited to moving around and to seeking the female cells. The body is made up almost entirely of the nucleus. In the higher plants the spermatozoids lack even the organs of free motion; they are carried to the egg-cell passively, in the pollen-tubes. The egg-cells are usually immovable and heavy in comparison with the male elements, since they contain the food substance necessary for the incipient growth of the germ, and for the first cell-divisions.

Now fertilization consists in the union of two cells, the male spermatozoid and the female egg-cell. This union is the means of combining the inheritance of the two parents, and therefore the nuclei play the main rôles. The nucleus of the egg-cell lies usually in its center; the male nucleus reaches it by passing straight through the surrounding plasm. Sometimes one sees quite distinctly that it no longer needs its own protoplasm since it strips it off and leaves it at the border of the egg-cell. In the *Cycadaceae,* in which the spermatozoa are just large enough to be discernible with the naked eye, the cytoplasm with all its cilia remains in the outer layers of the egg-cell, while only the nucleus penetrates more deeply. The beautiful investigations of Webber and Ikeno have brought this process to light.

Finally the two nuclei come into contact and unite into a single body. This is the most important moment of fertilization, the whole physiological process is concluded by this union.

Let us ask now what has been achieved by it. Appar-

ently very little, for the two parental nuclei are only closely appressed to each other. A penetration or fusion of their substance does not take place. They remain separate in spite of the union. With fertilization the life of the new germ begins, and in most cases immediately. Originally a single cell, the germ soon divides into two and then into more cells. But this beginning of the vegetative life takes place everywhere before the two parental nuclei have entered into closer union. Only after the first division does the limit become unrecognizable, the contact of the constituent parts of the male and female halves being now so intimate that there is at least the appearance of a fusion.

It was the Belgian investigator, van Beneden, who discovered this all-controlling fact. He first observed the independence of the paternal and the maternal nuclei in the intestinal worm, *Ascaris,* then elsewhere in the animal kingdom, and immediately recognized its significance. Since life could begin without fusion of the two nuclei, he considered that such a thing was not necessary, and assumed that all through life the two nuclei preserve their independence more or less completely.

According to this view the nuclei are double beings, and we thus find, in the material bearers of the hereditary characters, the duality of which Goethe sang in his "Sprüche in Reimen," and which the splittings of hybrids put so clearly before our eyes. Van Beneden chose the name *pronuclei* for the male and the female nuclei that are thus united, and speaks of a *pronucleus mâle* and a *pronucleus femelle.* This designation has been retained since that time, and recommends itself especially for the reason that the union of the two nuclei is usually simply called the nucleus of the cell; and this latter designation will probably not be changed, although the double nature of the nucleus is recognized. Therefore the pronuclei are

the entities that concern us; the nuclei are really double nuclei.

If the border line between the two pronuclei remained as distinct through life as before the first cleavage and at the time of it, van Beneden's view would hardly meet with any difficulty. But this is not so. Gradually the line of demarcation becomes blurred, and in most cases nothing more is to be seen of it in later life. But the richness of forms in nature is fortunately so great that the general phenomena in different organisms appear to us with an extremely varied distinctness. And thus it is also here. In one species the border line of the pronuclei is lost sooner, in others later. It is only a case of finding the best illustrations, that is, of selecting a species in which the paternal and the maternal inheritances remain longest visibly separate.

The discovery of such instances is the great merit of Rückert and Häcker. In the one-eyed water-flea of our fresh waters, the well-known *Cyclops vulgaris,* and its nearest allies, they found a group of animals in which the pronuclei remained distinctly separate for a long time. Sometimes during several consecutive cell-divisions, sometimes for a longer period, and, in the best cases, during almost the entire vegetative life, the double nature of the nuclei can here be directly seen. What van Beneden concluded from the incipient stages was here irrefutably proven.

The double nature of the nuclei was also demonstrated more or less distinctly, and during a shorter or longer series of cell-divisions, in other cases, by other investigators. It was observed in *Toxopneusthes* by Fol, in *Siredon* by Kölliker, in *Artemia* by Brauer, in *Myzostoma* by Wheeler, in the *Axolotl* by Bellonci. These and numerous other observations now place the law quite beyond a doubt. The independence or autonomy of the pronuclei corresponds

everywhere with the mode of union of the visible parental characters in the offspring.

In the snail-genus *Crepidula,* Conklin recently discovered a case in which the double nature of the nuclei can be demonstrated perhaps even more clearly and easily than in the Cyclops. If the two nuclei remain side by side all through life, the question arises as to how they dominate together the development of the child, the unfolding of its characteristics. Here, too, the results of physiology and of anatomy work beautifully together, and here too, Goethe's lines serve as a guide. Certain peculiarities are inherited from the father, others from the mother. One individual inherits them in this, another in that mixture. The inheritance therefore consists of separate qualities, which may be united in various combinations in the offspring. We are taught the very same thing by hybrids, especially in their progeny, and the rich floral splendor of our horticultural plants shows us what an endless number of combination-types has already been achieved with comparatively few characteristics.

But we shall not yet leave the subject of the nuclei. The independence of all the hidden potentialities, which in the physiological field is most sharply defined in the theory of pangenesis, we can of course not hope to see reflected in the nuclei. We must, at least for the present, be satisfied to find here any independent parts in the nuclei.

It was well known to the older investigators, and, among botanists, especially to Hofmeister, that the nuclei are not structureless formations, but that they exhibit more or less distinctly certain internal organs. But only about a quarter of a century ago by means of better methods of investigation did Flemming in the zoological field, and Strasburger in the botanical, succeed in getting a deeper insight into this structure, and soon afterwards Roux showed how these achievements are entirely in harmony

with the requirements of the theory of heredity. Since then, numerous investigations have confirmed and extended these results, and especially has Boveri brought out the main features in the wide range of phenomena. To him we owe the principle of the independence of the individual visible component parts of the nuclei, a principle, which, in spite of much opposition, is more and more strongly supported, and which has found in the most recent studies of Sutton a brilliant confirmation.

What Boveri's theory offers us is, in the main points, as follows: All the bearers of hereditary characters lie in the protoplasm of the nucleus, in the nuclear sap, as it is usually called, as definite particles, which can be brought out by various methods as distinctly recognizable parts, and which are combined into threads. It is true that one cannot see the individual bearers, because there are too many of them and they are too small. Even a counting of the smallest visible granules succeeds only rarely. In the nuclei of an American salamander, *Batrachoseps,* the members of the nuclear threads are most distinct; at least Gustav Eisen succeeded in making an approximate count of the smallest visible granules. In every pronucleus they form 12 chief parts, the so-called chromosomes. Every chromosome showed as a rule a subdivision into six sections or chromomeres, and every chromomere, in turn, appears again to be built up of six smallest granules, the chromioles. All in all there are here then about 400 distinguishable particles in the individual pronucleus. The number of hereditary characters must certainly be much higher than 400 for such an organism; it would more likely have to be estimated at ten times that value. We must therefore be satisfied, for the present, with the observation of groups of units in the nuclei.

In the end there will surely be found a way of seeing the individual units also. But the resolving power of our

microscope will finally reach its limit, and we shall probably never be able to see much smaller granulations than the smallest elements that are visible now. So far, even the causes of many contagious diseases, in plants as well as in animals, are still quite invisible. But the calculations which Errera has lately made on the limits of the smallness of organisms still allow us full play. In *Micrococcus* he finds a structure composed of about 30,000 protein molecules, but many nuclei are much larger. It can not yet be estimated of how many molecules a whole nuclear thread is composed, but it may be assumed with certainty that not every one of its granules has such a complicated structure that it could hold the factors for all peculiarities of the whole organism. Their smallness would rather lead us to suppose that every one of them could, at the most, represent only a small group of such units.

To prove this, on the one hand microscopically, on the other hand experimentally, is the task that Boveri set for himself.

The filamentous framework in most nuclei, recognizable by certain staining methods, is now admitted by all investigators as the idioplasm, the bearer of the hereditary qualities. This thread is very delicate, and seems to form a skein. But when the nucleus prepares to divide, the thread contracts, and thereby is seen, what had hitherto been invisible, that it is composed of several separate threads. In the nucleus there are several threads and not one single one. When the contraction of the thread is advanced so far that the individual parts have become quite short and thick, they are called chromosomes. In the nuclei of the body-cells these always occur in an even number, one-half belonging to the paternal, the other to the maternal pronucleus.

In a series of classical investigations Boveri succeeded in showing that the individual chromosomes, on elongating

again, when the division is accomplished, retain their independence. They remain the same during their whole life, elongating and shortening alternately throughout their entire development. The purpose of the shortening is to make possible an even division of all parts during cell-division; the threads then split lengthwise, in such a way that every single bearer of heredity first doubles, and then sends the two halves into the daughter-nuclei. This, of course, could hardly be accomplished in a skein. On the other hand elongation has for its object the freeing of the bearers of heredity from that crowded accumulation, their task being to control and to direct the life functions of the cell, and to that end they must be able to enter into as free a contact as possible with the granular plasm. An arrangement in rows, at least of those bearers that are to become active, is the necessary condition thereto, and it is evidently reached by means of the elongation of the threads and the formation of the skein.

In order to make possible an orderly retreat of the individual threads out of the tangle of the skein, every thread is firmly attached by one end to the nuclear wall. It retreats to this point, which is at the same time the point at which its two halves, during cell-division, are pulled apart after the splitting. The whole regularity of the process would be hard to explain without this firm implantation of the individual nuclear threads, as demonstrated by Boveri. Where the nuclei are sinuate and the nuclear threads are attached in the individual curves, the conditions are specially clear.

In a species of locust, *Brachystola magna,* Sutton found the same implantations of the nuclear threads on the curves of the nucleus. But here every thread, of which there are eleven in every pronucleus, forms a skein after the cell-division. These skeins of one and the same nucleus remain separated from each other for a long time, and the inde-

pendence of the chromosomes can hence be directly demonstrated, even at the stage of the skein. This locust has also proven very instructive in another point of Sutton's studies.

In general, one finds the individual chromosomes to be of unequal length in the most various nuclei. But, in the species of locust mentioned, this length occurs in such a characteristic manner that the chromosomes can be easily recognized in the successive cell-divisions. The pictures taken at the successive stages allow one to follow up, without difficulty, the identity of the short and thick nuclear threads. In doing so one sees that, in the double nuclei, the nuclear threads lie in pairs, that is, that there are two nuclear threads of each individual length. Evidently these belong together in such a manner, that in every pair one thread belongs to the paternal and one to the maternal pronucleus. A border line between them is nowhere to be seen, and yet their independence is very evident. And this harmonizes with the conception, as detailed above, that, according to the species examined, this limit can be observed for a longer or shorter time.

Microscopic examinations teach us, then, to recognize the independence of the two pronuclei, as well as the autonomy of the individual nuclear threads or chromosomes during the development of the entire body. The agreement of this observation with the phenomena of heredity may be considered as fully established.

But it is another question whether the individual chromosomes correspond also to special groups of hereditary characters, or, in other words, whether the bearers of the latter are strictly localized in the nuclear threads. This question can obviously be answered only physiologically. It amounts to a decision as to whether, if definite chromosomes, or definite parts in them, as for example, single chromomeres and chromioles, were wanting, definite ex-

ternal characters of the organism would also be lacking. If it were possible to kill a nuclear granule without otherwise injuring the germ, what would be the consequences?

Engelmann has taught us, in his revolutionizing investigation on the activity of the individual chlorophyll grains, how the focal point of a lens can be moved over the field of a microscopic preparation, thereby lighting up quite small portions of a cell, and how these portions can thereby also be heated, and in that way killed. If a part of a nuclear thread could be killed in this way, the externally visible consequences would certainly allow us to draw conclusions on the relations of this part to the hereditary characters. Perhaps an analysis of heredity can some day be made by this method, but the technique is not yet sufficiently advanced for this purpose.

However, there is another means of removing individual chromosomes, and this again we owe to the classical investigations of Boveri. He found it in abnormal processes of fertilization as they occur at times in eggs of sea-urchins and star-fish, and it can be quite easily produced artificially. It would lead too far from the main question to go into details here. The important point for our purpose is that, by certain interferences, a fertilization of one egg with two spermatozoa can be achieved. This process of dispermia leads in the nucleus of the germ, not to a double, but to a triple number of chromosomes. In the successive divisions the conditions become correspondingly intricate, and almost any imaginable abnormal number of chromosomes occurs. Nevertheless, the germs develop in some cases, and then show deviations from the normal type which allow a recognition of their normal relations to the structure of their nuclei. Without doubt the germs can, in every case, develop only those qualities the representatives of which happened to be preserved in their nuclei.

We shall leave the nuclear threads, at present, and

return to the two pronuclei. We saw them intimately combined during the entire development of the body. Now the question arises as to how long this union persists. And since the double nuclei of the body originated during fertilization, it is evident that the conjugating cells must have single nuclei, and therefore that the separation of the pronuclei must take place at the origination of these cells.

This fact is now so generally established, for animals as well as for plants, that it may be regarded as one of the strongest foundations of the whole theory of fertilization. Wherever it is possible to count the chromosomes, we find in the somatic cells twice as many as in the sexual cells. The former contain double nuclei, the latter single nuclei, or pronuclei.

The sexual cells in animals originate directly from the somatic cells, but in plants there is more or less preparation. Correspondingly, the two pronuclei separate in animals at the formation of the egg- and sperm-cells, but in the case of plants before that. In the seed-bearing plants it is the period of the origination of the mother-cells of the pollen and of the embryo-sacs. Therefore all cell-generations which appear after this moment, and up to the final production of the egg-cells in the embryo-sac, and of the sperm-cells in the pollen-grains and their tubes, possess only pronuclei. Such cells are called sexual, and the period of their formation the sexual generation. In ferns the entire life-period of the prothallium lies between the origination of the sexual cells and the appearance of the egg- and sperm-cells. This small plantlet, though built up of hundreds of cells possesses, therefore, as Strasburger has demonstrated, only pronuclei. The alternation of the sexual prothallia and the asexual fern-plant is called the alternation of generations; the two generations are hence distinguished from each other fundamentally by their nuclei, which in the leafy plants are always double nuclei, and in

the prothallia always pronuclei. This difference is so constant that one feels almost inclined to call the pronuclei prothallial nuclei.

At the moment when the two pronuclei separate, single nuclei appear in place of the double nuclei, and the double number of nuclear threads is thereby reduced to a single one. This process is usually called the numerical reduction of the chromosomes; but this imposing name means nothing but the separation of two nuclei which had so far worked together for a period. It is like the parting of two persons who have walked along together for a while, and will be looking for other companionship presently. And this they achieve by fertilization.

This parting has been minutely studied by numerous investigators. It has the appearance of a nuclear division of a very special nature, and is frequently called the reduction-division, or heterotypic nuclear division. It is necessarily accompanied by a cell-division, since the two separated pronuclei can only part in separate cells, but this cell-division does not always follow immediately, but only after a second essentially normal division of the nuclei. There result, in that case, four sister-cells instead of the usual two.

Shortly before their separation, the chromosomes lie together in pairs, always one in the paternal pronucleus united with the corresponding thread of the maternal pronucleus. They are placed lengthwise side by side. Hence the separation evidently occurs by a longitudinal line, and, in by far the greatest number of cases, this so-called longitudinal splitting of the chromosome-pairs has been observed in the origination of the pronuclei. It is true that this does not always succeed at a first glance, and it is right here that the differences of opinion between different investigators have blurred the picture for a long time. But gradually it was discovered that there are a number

of secondary details which may obscure the main features, and we owe it chiefly to Strasburger that the latter stand out clearly in the plant-kingdom. In the animal kingdom, however, there is still a series of cases which do not follow this rule, and where the chromosomes of the pronuclei are not placed lengthwise side by side at the moment of separation, but are connected at one end. Hence the separation here takes the form of a transverse division. Some insects and fresh-water crabs, some molluscs and worms offer the best known instances, but according to the most recent studies of de Sinéty, Cannon, and others, the assumption gains ground that here too the microscopic pictures, on closer observation, disclose a better fitting into the otherwise general scheme. It is also possible that, after the longitudinal splitting, the nuclear threads still remain connected for a while by their ends, before they finally separate.

The male and the female sexual cells usually originate in separate organs, frequently on special individuals. This goes to show that, at their origination from the body-cells, the paternal pronuclei do not become sperms and the maternal ones egg-cells. On the contrary, the two pronuclei of a mother-cell in the ovary can become egg-cells, and the two pronuclei of a pollen mother-cell can both give rise, by further splitting, to the formation of spermatozoids. Accordingly, one-half of the forming sperms gets paternal or now grand-paternal pronuclei, and the other half grand-maternal. The same is true of the egg-cells, and this holds good in spite of the circumstance that, in consequence of the crowded condition of the ovaries, the larger part of the female cells has regularly to be sacrificed every time.[3] Therefore fertilization may result in offspring with pronuclei from the grandfather or grandmother only, or from

[3] The reference is to the resorption of the sister-cells (when such occur) of the embryo-sac mother-cell. *Tr.*

both. This circumstance may not be without significance in considering the resemblance between grandparents and grandchildren among men.

But it is not by any means decisive; daily experience teaches that not only in a part of the progeny, but doubtless in all the offspring, there may be an admixture of the characters of the grand-parents also. This indicates that the separation of the pronuclei is not of as simple a nature as the microscopic pictures might lead one to believe. Another process, which, until now, has defied detection, must take place, probably in the smallest, but to us invisible granules of the nuclear threads. That this is the case we learn especially from the processes in hybrids and their propagation. Here, splittings and new combinations of the characteristics of the grand-parents occur in apparently incalculable numbers, and here it is distinctly seen that the pronuclei do not separate without a lasting reciprocal influence.

We shall first try to get a conception of this influence, for the facts concerning hybridization are rather involved; they can be most clearly explained by means of such a hypothetical conception. We shall accordingly assume a mutual influence as an established fact, and inquire how this can take place.

First of all it is clear that it must be finished before the separation of the pronuclei. Once they are apart all intimate relation between them ceases. They go their separate ways, each living for itself. Only in the double nuclei do the paternal and the maternal pronuclei lie so close together that their individual parts can exercise an influence on each other.

We have further seen that, during the life of a double nucleus, throughout the successive cell-divisions, from the origination of the germ to the complete formation of the offspring, the contact of the pronuclei becomes gradually

more intimate. Before the first cell division they are, as a rule, still visibly separated; soon afterwards the border-line begins to look more indistinct, and, shortly before the formation of the sexual cells, the double nature is disclosed with certainty only in the rarest cases by special structural relations. It is, therefore, clear that their opportunity for mutual influence gradually increases during somatic life. Perhaps it first occurs only at the end, possibly even, only at the moment immediately preceding their separation. A decision on this point has not yet been reached.* But the above-mentioned vegetative splittings of hybrids indicate that the process is deferred as long as possible. It also seems simpler to assume that it occurs only in those cells which actually lead to the formation of sexual cells, because in the leaves, bark, and other vegetative parts of the body, it would evidently be without significance.

We therefore imagine the mutual influence to be exercised towards the end, or even at the very last moment before the separation of the pronuclei. In the first case it could extend over a long time; in the latter it must take place suddenly. In the first case the individual parts of the nuclear threads could be mated one by one; in the latter this would have to take place everywhere simultaneously.

How this process comes about is self-evident when we assume special units, special granules in the nuclear threads, for the visible characters of the organisms. There must be as many units in the nucleus, as a plant or animal possesses individual characters. And this, of course, is the rule for both pronuclei. In the condition of the short and thick chromosomes these units lie crowded together. This is a definite stage in cell-division; the units, at least those

* More recent investigations indicate that the fusion of the male and female chromatin elements is completed during the stage known as "*synapsis*," which immediately precedes the reduction-division, or heterotypic nuclear division, referred to above. During synapsis the chromatin is aggregated into a compact mass within the nuclear cavity. *Tr.*

of the interior of the group, remain in a condition of enforced rest. But as soon as cell-division is completed, the nuclear threads stretch; they become quite long and thin, and indeed so long that a large part, perhaps most of them, possibly all of them, come to the surface. At least stretched out in a row in this way, the granules must then be arranged one after another, perhaps in the threads themselves, perhaps in their finest ramifications. Now they become active, and if, at this time, nuclear threads of the paternal and the maternal pronuclei lie together in pairs, every granule can enter into communion with its corresponding unit in the other pronucleus.

There is no reason to assume that the exceedingly fine structure of the nuclei, which is so strikingly to the purpose and yet so simple, should be limited to what is visible to us at present. On the contrary everything points to the probability that, in the internal structure also of the nuclear threads this same serviceable rule must prevail. The whole complicated process of nuclear division has for its object the division of the two pronuclei in such a way, that their daughter-nuclei will share alike in the hereditary characters that are present. The lengthening of the nuclear threads at the close of division, their so frequent ramification, and the seemingly irregular intertwining of their parts, evidently indicates the possibility of a domination of the cell-life by the bearers of the inheritable qualities.* These must impress their character on the surrounding protoplasm either dynamically or, as I have assumed in my *Intracellulare Pangenesis,* through a giving out of material particles to the surrounding protoplasm, and thus promote growth and development, in the prescribed direction, into the specific form of the species to which the organism belongs.

This secretion of material chromatin particles from the

* The "pangens."

nuclei was recently demonstrated by Conklin in *Crepidula*. In this way considerable quantities of chromatin, and therefore probably of pangens also, are transferred into the somatic protoplasm.

Thus we consider that the structure of the nuclear threads is such that it not only makes possible, but regulates and dominates the relations of the two pronuclei. In an ordinary animal, or in a plant which is not a hybrid, both pronuclei possess the same units, only with a somewhat unlike degree of development. We assume, therefore, that the cooperation comes about in such a way that the individual units in the stretched threads lie in the same numerical order. Then, when the threads are closely appressed lengthwise, in pairs, we can imagine all the like units of the two pronuclei to lie opposite each other. And this is obviously the simplest assumption for a mutual influence.

If every unit, that is, every inner character or every material bearer of an external peculiarity, forms an entity in each pronucleus, and if the two like units lie opposite each other in any given moment, we may assume a simple exchange of them. Not of all (for that would only make the paternal pronucleus into a maternal one), but of a larger, or even only a smaller part. How many and which, may then simply be left to chance. In this way all kinds of new combinations of paternal and maternal units may occur in the two pronuclei, and when these separate at the formation of the sexual cells, each of them will harbor in part paternal, in part maternal units. These combinations must be governed by the laws of probability, and from these, calculations may be derived, which may lead to the explanation of the relations of affinity between the children and their parents, the grandchildren and their grandparents. On the other hand a comparison of the results of this calculation and of direct observation will form the

best, and for the time being, the only possible means for a decision as to the correctness of our supposition.

The mutual influence of the two pronuclei shortly before their separation is therefore brought about, according to our view, by an exchange of units. Every unit can be exchanged only for a like one, which means for one which, in the other pronucleus, represents the same hereditary character. This rule appears to me to be unavoidable and really self-evident. For the children must inherit all specific characters from their parents, and they must also transmit all of them to their own progeny. This exchange must hence be accomplished in such a way that every pronucleus retains the entire series of units of all the specific characters, and this result can evidently be obtained only when the interchange is limited to like units.

We distinguish here specific characteristics from individual features. The units in the hereditary substance of the nuclear thread compose the former. Every species has an often exceedingly large and yet definite and invariable number of them. The sum total of these units forms that which distinguishes any given species from all others, even from its nearest allies. A complete diagnosis of a species would have to embrace all of these characteristics, and therewith all the material bearers underlying them.

The individual features, that is, the differences between the individuals within the species, and not only of the systematic but of the so-called elementary species, are of quite another nature. It is true that they are, in a way, hereditary, but with that they are subject to constant changes. The average stature of man remains the same in the course of centuries, for the same race (elementary species), but the individual stature changes constantly from one individual to another. In the somatic cells of man the bearers of the stature of the father lie opposite those of the mother. At the moment of exchange these are mutually transferred,

and the sexual cells receive partly one, partly the other stature, but this in the most various combinations with the other characters. Thus one might continue. Every visible quality, every trait of character is to be found in all individuals, only in some they are strongly developed and prominent, in others weak and recessive. Ordinary observation takes more interest in differences than in similarities, and for this reason the former are designated by contrasting expressions, as large and small, strong and weak, forward and modest. But these are, in each instance, only degrees of the same hereditary characteristic, or the same trait of character. And such more or less differing stages of development of the same inner units we represent to ourselves as the entities which are exchanged by the nuclear threads.

Individual differences are thus not included in the type of the species. They form deviations from this type, and are conditioned by causes which were formerly generally described as conditions of nutrition, but now more frequently as environment. Under these influences every character can develop more or less strongly than the average type. And the environment, provided it remains constant during the entire period of development, must affect all the unfolding characters in the same way. If it is favorable it furthers all parts of the body and all mental gifts, if it is unfavorable it has the opposite effect on all of them. Not, by any means, to the same degree upon all of them: that does not depend upon the environment but upon the units themselves; this, however, can not lead to essential differences between separate individuals. But our supposition of such a uniform environment would probably be met with only in the rarest of cases. And, as soon as it changed, it would influence one individual differently from the others. Moreover the characters do not unfold simultaneously, but successively, the higher one for the most

part later than the lower ones, mental characters later than those of the body, the reason later than the memory. And all those wheels work into each other so that small deviations will rather tend to become greater than to be equalized. Though children of the same parents but of different age might, during their entire youth, live under the same circumstances, they will yet react differently to them. This also holds true for plants where, in the same bed, a delay of only one day in germinating will, according to the weather, lead either to equal or to quite surprising differences in size and qualities.

If favorable and unfavorable conditions of life alternate during the individual development, and if they strike a group of individuals sprung from like seeds at different periods of their growth, quite a considerable degree of individual differences must thereby result.

These differences play in nature the same rôle as in human society. One is adapted for this kind of task, the other for that. With men it is the duty of every one to develop his own talents to the best of his ability, and to render as favorable as possible the circumstance for the most perfect development of his children. The highest efficiency of society in general demands of each the strongest effort in the direction of his most favorable talents. To ascertain this direction ought to be one of the chief aims of education and instruction. In animals and plants this highest efficiency can obviously not be achieved in the same way. And especially are the conditions different for plants, which are tied for life to the place where they germinated. Here, as is well known, nature is assisted by the astonishingly great number of seeds; she sows so many in every individual spot that only the best, that is, the individuals best adapted for the given locality, need retain life. But, by sacrificing countless seeds, she also accomplishes here that adaptation of the individual

specimens which is the condition for the complete unfolding of their abilities and advantages.

Very great weight is therefore given to individual differences in the life of the entire species. The greater they are, the greater the power of adaptation, the greater the chance of victory.

And in this I see the significance of sexual reproduction. It mixes the potentialities that have developed in the single individuals in the most complete manner imaginable; it achieves, at one stroke, all possible combinations. It cancels, as Johannsen expresses it, the previous correlations. Asexual propagation confers a certain degree of variability, and this may be quite sufficient in many cases, especially in the case of a low organization or of quite special adaptation, as in many parasitic and saprophytic organisms. Under such conditions the variability remains, in a certain sense limited, more or less one-sided, because every individual is the result of the varying, but, on the whole, one-sided environment in which his progenitors existed. Only an exchange of qualities can help to overcome this one-sidedness; only this can cause all the combinations to arise which are demanded by the varying environments. If we assume that the bearers of the individual characters are, as a rule, independent of each other during their exchange, and also that the latter is ruled by chance, two pairs of characteristics would directly result in four, three in eight, four in sixteen combinations. The sum total of the points of difference of two parents must therefore give rise to such an incredible number of possibilities that no struggle for existence, no annual rejection of hundreds and thousands of germs could demand a richer material.

Hence sexual reproduction brings individual variability to its highest point. It produces a material that corresponds to almost any environment. It is the principal

condition for the greatest efficiency of cooperation, be it by a selection as free as possible of the line of development for the single individuals, or by a sacrifice of all the individuals that do not quite meet all the requirements.

This service of sexual reproduction is evidently not limited to a single generation. It exercises its influence throughout successive generations, and it is probably indifferent whether the effect follows directly, or whether it manifests itself in the course of time. Even without that, the complete utilization of all given possibilities requires, as a rule, more individual beings than are born in a single generation. And with this, the otherwise strange fact is explained, that the exchange of the units does not immediately follow fertilization, but only takes place a short time before the succeeding period of fertilization. But obviously an exchange, ruled by laws of chance, could not benefit a given isolated individual or, more correctly speaking, it would most likely, just as frequently be harmful as useful. It can only be of use in connection with an increase in the number of individuals, for it is its task to bring about as great a variety as possible, and with that, the highest possible prospect for the required quantity of superior specimens. At the moment when the production of the sexual cells begins, in such enormous numbers, it also finds the best opportunity for fulfilling its task.

Thus, sexual reproduction has only a subordinate significance for the children, while for the grandchildren it is of the utmost importance, because only for them does the urn mix up all its lots.

The same laws that govern normal fertilization, are, of course, valid for hybrids also. There cannot be special biological laws for them, because they are only derived phenomena, deviations from the normal. Now the question is, to which results, departing from the rule, will the common laws lead in these special cases. And with this

it is clear that the phenomena must keep nearer to the normal the less the deviation is from the type.

This type is conditioned by the fact that the two organisms that fertilize each other belong to the same small or elementary species. They have then, on the whole, the same characters, even if these are, according to their environment in various degrees of development. There are no differences among them independent of this, at least if we consider the cumulative effect of uniform influences in the course of several generations.

As soon as such independent differences occur, and as soon therefore as there are present constant contrasts, which are retained in the sequence of generations and cannot be blended by environment, we call the sexual union of two individuals a crossing or a hybridization. If the contrasts are slight, we call the two races varieties, if they are greater, they assume the rank of species. The crossing of varieties keeps quite near to normal fertilization; that of the species deviates the more the slighter the relationship between them. The crossing of varieties forms a type complete in itself, that of the species forms a series which descends from almost normal processes, by gradual progress, to a complete reciprocal sterility. The variety-hybrids are fertile like their parents, but in the species-hybrids the diminished fertility indicates abnormal phenomena either in fertilization or in the exchange of the units.

We must therefore discuss these two groups separately, and we shall begin with the varieties.

In daily life and in horticulture, any thing that deviates from the normal is called a variety. Even the new forms obtained by crossing are quite commonly counted among the varieties. In science, therefore, the word would really be useless. Nevertheless it has been retained and its meaning has been gradually limited. Especially in describing

horticultural plants the conception is sufficiently restricted by excluding on the one hand the hybrids, on the other hand the improved races obtained by selection, and finally the so-called elementary species that, taken together, form our ordinary species.

Upen reviewing the cases that are left, two types can be plainly distinguished, the constant and the inconstant varieties. The former are not inferior to true species in point of constancy. Their character varies, in the single individuals, around a mean, but in the main not more so than the corresponding characteristic of the species. From this they are separated by a decided chasm. In pure fertilization they never bridge this chasm, or at least, extremely rarely, but in crossing they revert very easily to the species. It is this very reversion that stamps them varieties, and when the crossing is not artificial but natural, brought about by insects, it escapes observation, and only the fact of the reversion strikes the gardener.

These constant varieties are, as a rule, distinguished from the species to which they belong, by lacking some striking quality that adorns the latter. Most frequently it is the coloring of the flower or, in the case of flowers with combined colors, as in the yellow and red tulips, one of the individual colors, that is wanting. Often they lack hairs or thorns, very frequently the development of the blade is arrested, and split leaves originate. In all of these cases there is no ground for the opinion that the failure of the visible character means also the loss of the respective unit. Rather does everything point to the fact that the unit has simply become inactive, that it is in a state of rest, or as it is usually expressed, that it has become latent. Especially the reversions, which in individual specimens of such varieties are, at times, quite common phenomena, betray this latent presence.

Inconstant varieties are distinguished by a strikingly

high variability, by an exceedingly great range of departure from the norm. But here we encounter the double meaning of the designation inconstancy. On the one hand the word means a certain relatively great richness of individual forms, on the other hand it relates to differences between the parents and the progeny. In choosing from an inconstant variety a single individual, and sowing its seed, after pure fertilization, the whole play of forms of the variety can be found again in the children,—hence a palpable proof of the inconstancy. But, on choosing several individuals, and on sowing their seeds separately, each of them will produce almost the same series of forms. The whole group is transmitted from year to year, and does not change. The variety has a definite circle of forms in which the descendants of every specimen choose freely their place, but they do not go outside the circle. The limits are constant, and remain so in the course of generations; within the limits, however, a motley variety prevails.

Such is the concept of plants with variegated leaves, of double and striped flowers, and many other most highly variable garden-plants. The new character is not based here on the loss or the latency of some characteristic of the species. Indeed, on the contrary, it is usually a peculiarity which is already present in the species itself, or at least in one of its races, in a latent state. Especially do variegated leaves occur, not so very infrequently, on otherwise green plants, and the same is true of stamens with petal-like broadenings. The relation of the inconstant varieties to the species from which they are derived, is therefore quite different from that of the constant varieties.

Nevertheless, the two crossings behave in the same manner in regard to their mother-species. From the latter they are distinguished, for the most part, only in one point, though sometimes in several. But we have always to deal

with the distinction between active as contrasted with latent, be it that the given character is active in the variety and latent in the mother-species, or latent in the former and active in the species itself.

If to this we apply the conception of the arrangement of the units in rows on the nuclear threads, as explained above, it is quite evident that everything will follow exactly the same course as in normal fertilization. Every unit in the paternal pronucleus corresponds to the representative of the same peculiarity in the maternal one. The nuclear threads fit as nicely into each other as in a pure species, and all the units which do not directly bring about the point of difference behave quite normally. Cooperation in vegetative life, and exchange during the formation of the sexual cells need not be disturbed. We may confine our whole consideration to the point of difference, and we shall select, for the purpose, as simple an illustration as possible, one in which there is only one difference between the species and the variety, for example, the color of the flower.

The material bearer of the color-characteristic is situated in the mother-species so that it can display its full activity while in the variety it is unable to do so. If the paternal and maternal nuclear threads of the hybrid come into contact for the purpose of exchange, and with the same sequence of units in both, the active unit of coloring matter naturally gets the equivalent inactive unit as an antagonist. With this it must therefore be exchanged. We assume that in this the latent condition is without significance, that hence the exchange comes about in the same manner as in normal fertilization.

Over this, however, the crossings of varieties have the great advantage that there the origin of the characteristic in question can always be clearly and positively recognized. Both units of a pair of antagonists are otherwise distinguished only by a more or less of development, here by a

sharp contrast. And for this reason it is experimentally much easier to discover the laws with varieties than with purely individual differences.

In doing this, two points have to be distinguished; the consequences of fertilization and the consequences of the exchange of the units. The former we see in the hybrid itself, the latter in its descendants.* And since fertilization and exchange are two such fundamentally different things, we must not wonder that there exist such decided differences between a hybrid and its descendants. These differences show themselves essentially by the fact that the hybrids of a mother-species with a variety of the same are alike, even if they are obtained in great numbers, while their descendants always display a certain variety.

Let us first consider the first generation of variety-hybrids. How do the two pronuclei, notwithstanding their inequality, cooperate in order to regulate the evolution? This question amounts to the same as asking, what is the sum of the influence of an active and a latent unit? At first glance one would expect that this influence would correspond to half the value of a pair composed of two active units. Previously this opinion was rather generally accepted, and there was an inclination to regard plants with intermediate characters as hybrids. Especially many plants with pale red or pale blue flowers were regarded as such. But the experience of later years has decided differently.

Variety-hybrids generally bear the characteristic of the species, sometimes fully developed, sometimes more or less weakened, but this for the most part only so little that

* In the fertilized egg, resulting from the crossing, the chromatin from the male and female parents is not completely fused. As pointed out in a preceding footnote (p. 534), this fusion, called synapsis, occurs as almost the last step preceding the nuclear and cell-divisions that give rise to the reproductive cells. The characters of the first hybrid generation are a result of fertilization. Following synapsis, the pure bred offspring of this generation differ from their parents and also among themselves. *Tr.*

superficial observation sees no difference. An active and a latent unit are not essentially different in their cooperation from two active ones; a fact which may probably be best explained by the assumption that two cannot accomplish more than one already does. This conception finds a very strong support in the results of the most recent investigations by Boveri on dispermia, which we have already partly discussed. By fertilizing one egg with two spermatozoa the composition of the structure of the nuclear threads can be altered in different ways, for instance, in such a manner that in one nucleus there lie not two, but three pieces of any one of its chromosomes. It might then be expected that the given characters would be very strongly developed, to about one and one-half of their intensity. But, as far as can be judged from Boveri's experiments, this is not the case, and the influence of the three equivalent units is not noticeably greater than that of two.

We come now to the progeny of hybrids, and we, of course, presuppose self-fertilization. At the formation of the sexual cells the two pronuclei separate; this happens at the origination of the egg-cells as well as of the sperms. Through exchange, the active unit of our differing pair combines partly with new units of the other pairs, and thereby new combinations originate as in ordinary fertilization. But if we consider only the differing pair, exactly one-half of the egg-cells must obviously have the paternal, and the other half the maternal character. Or, in other words, in one-half of the egg-cells the given character occurs in the active, in the other in the latent state. Exactly the same is true of the male sexual cells, the sperms, in animals as well as in plants, and independently from the circumstance that in the higher plants the sperm-cells are conducted to the egg-cells in the pollen-tube.

The male sexual products of a hybrid are therefore unlike each other, and the same holds true of the female. In the simplest case selected both groups consist of two types, in the more complicated cases this number will obviously become greater. The paternal and maternal factors of the hybrid become, in its progeny, grandpaternal and grandmaternal. Hence, in regard to the point of difference, one-half of its egg-cells and one-half of its sperm-cells have grandpaternal factors, while the other halves possess grandmaternal ones.

By means of this principle the composition of the progeny in the simple as well as in the complex cases, and for constant as well as for inconstant varieties can be calculated. Thus we obtain the formulæ which are now universally known as Mendel's law.

They indicate, for any given number of points of difference between two parents, how many children correspond to every individual combination of the respective character. And, on the whole, experience has so far proven the reliability of these formulæ for animals as well as for plants.

It would be too great a digression to consider here the formulæ themselves. We shall therefore leave the field of the variety-hybrids, and turn to the hybrids between different species, especially between allied elementary species.

In order to understand these we must get a clear idea of the nature of the points of difference in this case, or in other words, what is meant by relationship. Species originate from each other in a progressive way. The number of the units in lower organisms is evidently only small, and must gradually increase with progressing organization. Every newly arising species contains at least one more than the form from which it has arisen. Only in

this way can one imagine the progress of the entire plant and animal world.[4]

It is indeed questionable whether the acquisition of a single new unit, the increasing by one unit of the entire stock, amounting to hundreds and thousands, would be sufficient to make the impression of progress on us. The difference will in most cases be too slight. Only when two or three or more units have been added successively to those already present, will we recognize an increase in the degree of organization.

The progress of every individual species can apparently take different directions. In some genera there are species so typical that they may be regarded as the common origin of the others. Where these are lacking it is manifest that the systematic relations are still too incompletely known to us, or that the given forms have died out. Every species can therefore be compared with its own ancestors or with other descendants of the same ancestors.

This consideration leads us to the recognition of two different types of relationship, and therewith also of two groups of crossings between allied species, which have to be kept absolutely apart. One of them we shall call the avunculary, the other the collateral. In the first case we cross a form with an "avunculus" or ancestor in the direct line, in the latter case with one of its lateral relatives. Obviously the first relation is very simple while the latter is more complicated.

Every character and every unit corresponding to it,

[4] A quite different hypothesis is thinkable, as, for example, that suggested by G. H. Shull, "The Significance of Latent Characters," *Science*, N. S., XXV, 792, 1907.

"All the visible variations of the present plant and animal world were once involved in some generalized form or forms, and the process of differentiation pictures itself to us as a true process of evolution brought about by the change of individual character-determining units from a dominant to a recessive state. This conception results in an interesting paradox, namely, the production of a new character by the loss of an old unit."

This hypothesis, however, as de Vries has pointed out, seems too much like a revival of the old involution theory as opposed to epigenesis. (C. S. G.)

which in a crossing is present in one species and lacking in the older one, forms a special point of difference. Hence the simplest case is the one in which there is only one such difference between the two parents of a cross. But generally several of them exist.

Now in such a cross, the differing factors evidently do not find any antagonists in the sexual cells of the other parent. When, during fertilization, the pronuclei unite into a double nucleus, all the other units are present in pairs. Not so the differing ones; they lie unpaired in the hybrid.

If we apply this reasoning to our conception of the arrangement of the units in rows on the nuclear threads, the immediate result would be that their cooperation must be disturbed. The threads no longer fit, neither during fertilization and in vegetative life, nor later when the units are exchanged before the formation of the sexual cells.

If we imagine two corresponding chromosomes of the two pronuclei placed exactly side by side, and in such a way that every unit of the one has the corresponding unit of the other for a neighbor, this will occur in a species-cross only as far as the point of difference. Here one nuclear thread has one unit more than the other. The latter has, so to say, a gap.

The greater the number of points of difference, the more numerous are these gaps, and the more will the cooperation of the two nuclei be interfered with. And this must diminish the vitality of the germ or at least the normal development of all characters.

If the differences between the two parents are too numerous, a crossing, as is well known, remains quite without effect. Crossings between species belonging to different genera succeed in very rare cases only, indeed within by far the most genera even the ordinary systematic species are not fertile when united. Genera such as *Nicotiana,*

Dianthus, Salix, and others, which are rich in hybrids, are, as a rule the very ones in which the species are exceedingly closely related to each other.

Even if the agreement of two species is great enough for mutual fertilization, the life of the hybrid is by no means assured thereby. Some of them die as seeds within the unripe fruit, as has been specially described by Strasburger for the hybrid seeds of *Orchis Morio* after fertilization with O. *fusca.*

Others become young plantlets, but are too weak to develop any further, and perish during the first weeks after germination, as I have frequently seen, for example after crossings of *Oenothera Lamarckiana* and *O. muricata.* Or only the most vigorous individuals continue to grow while the weaker ones perish, and this, in dioecious plants sometimes results in the male seedlings perishing while some of the more vigorous female ones develop flowers, as Wichura observed in several willows. Finally there might originate hybrids that grow vigorously, but do not flower at all or only incompletely, or begin too late to do so. There is a whole series of cases between the unsuccessful crossings and the development of hybrids into adult plants. And on the whole this series runs parallel with the increasing systematic relationship.

If the hybrid has succeeded in reaching the period of flowering, that is, the period of the formation of the sexual cells, a new difficulty arises at the moment of the exchange of the units. Whereas, up to that time, the cooperation of the two pronuclei was more or less disturbed, now the gaps become very important. Hence the quite common phenomenon that the production of egg- and sperm-cells fails more or less completely, that the hybrids either produce no ovules that are capable of being fertilized, or no good pollen, or neither. They are more or less or even completely sterile. They either form no seed at all, or only

an insufficient quantity. Only where the differences between the parents are quite small, does one succeed in harvesting any seed, and even here, frequently only a little.

How the unpaired characters behave during the exchange, when they are not numerous enough to make a failure of the entire process, is at present unknown. Experience teaches, however, that in these cases the descendants of the hybrids do not display that multifariousness of type, nor those splittings that are characteristic of variety-hybrids. They usually all resemble each other and their parents, the original hybrids, and this constancy persists through the course of generations. Accordingly there originate races of hybrids which, apart from their possibly diminished fertility, can hardly be distinguished from true species. Sometimes they are found wild, as for example a hybrid race between two Alpine roses, and other races of the kind in the genera *Anemone, Salvia, Nymphaea,* etc. Sometimes they have been obtained artificially or have accidentally originated in the gardens. The genus *Oenothera* is exceptionally rich in such constant hybrid races, especially in the sub-genus of the common evening-primroses, *Onagra.* Very frequently such hybrids are simply described as species, on the one hand because they can be reproduced, without deviation, from seeds, and on the other hand because systematic works frequently do not sufficiently consider the elementary species. The distinguishing of the latter from hybrid races is frequently by no means easy.

The purpose of my explanations compels me to restrict myself to simple and clear cases. In nature these occur relatively rarely, and the individual elements of the phenomena are usually commingled in most motley variety. By far the greater number of crossings take place between parents, whose mutual relations do not wholly fit either the one or the other concept, but where the characteristics

of the different types of hybrids are intermingled. I cannot consider these cases here; they are of too complicated a nature for an address.

Only one point I wish to touch upon. In the preceding pages I have always taken for granted that the species and varieties are in their ordinary and unchanging state. But this is by no means always the case. The origination of new species and varieties demands that their immutability should not be absolute, or at least should be suspended from time to time. Experience confirms this by showing that there are periods in the life of species, during which they are, so to speak, especially inclined to produce new types. At that time they produce the new varieties and species, not only once but repeatedly, and not only a single one, but frequently a considerable number. Genera rich in species, such as the pansies and the rock-roses,[5] are the remains of such periods of variability, and everywhere in nature we meet with similar ones. In garden-plants we see, from time to time, periods during which certain varieties occur by preference, as the double dahlia of about the middle of the last century, the forms of tomatoes in recent decades, and numerous other instances teach us. On its first appearance the gardeners call the new form a conquest, the later appearances are only repetitions, and are therefore of only very secondary practical value.

The power of reproducing one or more new species indicates a condition of unstable equilibrium of the given internal units. In the nuclei the new characteristic is already invisibly present, but inactive. Certain causes, unknown to us, can transform this into a permanent condition. This state of unstable equilibrium may be maintained in the great majority of individuals, through a series of generations, as is the case with my *Oenotheras*. But from time to time, sometimes in individual cases, every

[5] *Sonnenröschen* (*Helianthemum*).

year, there is a shock, and the equilibrium becomes stable. The given individuals overstep their bounds, abandon the earlier type, and form a new species.

It is evident that in crossings such unstable units will behave differently from normal, stable ones. Their chance of becoming stable is evidently considerable, owing to the phenomena of fertilization and the exchange of units. In this way constant races originate, at least in the genus *Oenothera,* and this, on the one hand, with the respective characteristic in an unstable condition, or in other words, in a state of mutability; and on the other hand with stable equilibrium corresponding to a new species. But researches in this field are only in their beginning, and do not yet permit of a detailed analysis. Besides they represent, for the present, a case in themselves.

* * *

On reviewing, in conclusion, the course of our deductions, we see that hybrids follow normal fertilization quite closely, the more completely the less numerous and the less pronounced the points of difference between the parents of the crossing. If these are of such a kind that the number of units in one parent is different from that in the other, disturbances take place which, if of lesser influence, diminish the fertility of the hybrids, and if of greater significance, affect their own power of development, or even make the crossing a failure. If these units are present in equal numbers on both sides, and if the differences are limited to latency in one parent and activity in the other, the normal process is not at all disturbed, but striking phenomena occur, which find their explanation in the peculiar manner in which the parental inheritances cooperate in the hybrid and in the formation of its sexual cells.

This cooperation is reflected in the life of the nuclei. In fertilization the nuclei of father and mother simply

touch each other. In the course of development the contact becomes gradually closer, bringing their equivalent elements as near to each other as possible, in such a way that the latter finally all lie side by side in pairs. But the pronuclei by no means lose their independence thereby, and for the purpose of every nuclear division they separate their component parts more or less distinctly. Shortly before their separation, their leave-taking, they are still the same as before. But now they exchange their individual units, and thus cause the creation of those countless combinations of characters, of which nature is in need in order to make species as plastic as possible, and to empower them to adapt themselves in the highest degree to their ever changing environment.

This increase of variability and of the power of individual adaptation is the essential purpose of sexual reproduction. It can be attained only by a mutual combination in all conceivable forms of the peculiarities developed in different individuals in different directions and degrees. To this end the pronuclei mutually exchange their units from time to time, and by assuming, on the ground of experiments with hybrids, that this takes place, on the whole, according to the laws of chance, that is, according to the theory of probability, we have gained a basis which allows us to probe to its very bottom this most significant and mysterious process.

HUGO DE VRIES.

AMSTERDAM, HOLLAND.

THE NATURE OF VITAL PROCESSES ACCORDING TO RIGNANO.

[CONCLUDED.]

EXPLANATION OF ASSIMILATION.

(Rignano, p. 356): "The fact that strikes us first of all is, that the vital phenomenon depends upon continual reproduction, for assimilation constantly reproduces the substance which is gradually consumed. It is to be expected, therefore, that if there are any fundamental properties of living organic substance which explain the phenomena of development or of reproduction in general, they must then be capable of accounting for assimilation also inasmuch as it is itself also a phenomenon of reproduction.

"That being granted it will be worth while that we next stop for an instant to take a look at and consider briefly a few of the principal conceptions which biologists have put forward on the nature of either the vital phenomenon or of assimilation, and which are of the greatest interest from our point of view.

"Roux, for example, rightly urges that the nature of life must be dynamic. 'Life is in its essence a process, and cannot therefore have a static definition. It is therefore only a processive and consequently functional definition which can approximate the essence of organic life.'[1]

"On the other side we have already seen the reasons

[1] Roux, *Ueber die Bedeutung der Kerntheilungsfiguren.* Leipsic, Engelmann, 1883, p. 18. Gesamm. Abhandl., Bd. II, p. 142.

for concluding that the essence of the vital phenomenon consists in an activation of nervous energy. We recall that according to Orr for example, the fundamental property of living substance is an 'elemental nervousness.'[2]

"We have already seen also that Claude Bernard, in agreement with that, considers the sensibility of the nervous substance as nothing else than a particular modality of irritability, which would be a general property of all living substance. 'Sensibility,' writes he, 'considered as a property of the nervous system, is only a higher degree of a simpler property which exists everywhere in all living substance both animal and vegetable. It has nothing essential or specifically distinct. It is the special irritability of the nerve just as the property of contraction is the special irritability of the muscle and as the property of secretion is the special irritability of the glandular element. These phenomena are so many different degrees of one and the same elementary phenomenon.[3]

"Bard also remarks, that, if the nature of the energy constituting the basis of all vital phenomena must be single, the infinitely varied modalities which these same vital phenomena present must then be due to as many corresponding modalities of this single energy."[4]

Here must be considered the conception which Rignano has himself formed of the general nature of vital energy and which has already been stated in the introduction. He says (p. 361 ff.): "Vital energy, nervous energy, we must admit, will certainly be only a particular case of more general physico-chemical forms of energy already known, or yet to be known, and as such must necessarily be subject to the laws governing the latter, and also *a fortiori* to

[2] Orr, *A Theory of Development and Heredity.* New York, Macmillan, 1893, p. 86.

[3] Claude Bernard, *Leçons sur les phénomènes de la vie communs aux animaux et aux végétaux*, pp. 289-290.

[4] Bard, "La spécificité cellulaire et ses principales consequences," *La semaine médicale.* Paris, 10. Mars 1894, p. 116.

the laws governing all energy in general. But also as such, i. e., as a particular case of more general physico-chemical forms of energy, it will have in addition special laws of its own, which are only experimentally to be determined, and can not simply be deduced from the more general laws, even though it must always be subjected to them also. And these laws of its own are exactly what make of it, from a simply physico-chemical energy, vital energy. It is just this conception to which we have been led when we have attributed to nervous energy, taken as the fundamental basis of life, special properties, which electric energy, in certain respects related to it, does not on the contrary possess.

"If, passing on now to assimilation, we examine the conception which the biologists have made of it, we shall see that their opinions on that subject are quite remarkably concordant.

"Thus, for example, Lewes says: 'The peculiarity of vital processes consists in this; that living matter undergoes molecular changes of composition and decomposition which are simultaneous, and by this simultaneity it preserves its integrity of structure.'[5]

" 'Life,' remarks in his turn Oscar Hertwig, 'manifests itself, expressed in the most general terms, in this, that the cell, by virtue of its own organization and under the influence of the external world undergoes continual changes and develops forces whereby its organic substance, on the one hand continually destroyed with determined manifestations of energy, on the other hand is regenerated.' 'The life process depends then on a continual destruction and re-formation of organic substance.'[6]

"But the clearest and most suggestive of all is Claude

[5] Lewes, *The Physical Basis of Mind.* London, Kegan Paul, Trench, Trübner & Co., 1893, p. 5.

[6] Oscar Hertwig, *Die Zelle und die Gewebe,* Bd. I, p. 54, and Bd. II, pp. 190-191.

Bernard in the following celebrated passage, 'The characters of life considered in their essence and in their entirety can be classed in two great groups:

" '1. The phenomena of consumption, of vital destruction, which correspond to the functional phenomena of the organism.

" '2. Plastic phenomena or phenomena of vital creation, which correspond to functional repose and to organic regeneration.

" 'Everything which goes on in the living being is in relation to one or other of these types; and life is characterized by the union and combination of these two orders of phenomena.

" 'Disorganization or "dis-assimilation" uses up living material while the organs perform their functions. Assimilative synthesis regenerates the tissue. It reassembles the reserve materials which the functioning organism must use up. These two processes of destruction and renovation, although inverse, are absolutely connected and inseparable, in the sense at least that destruction is the necessary condition of renovation. The phenomena of functional destruction are themselves the precursors and instigators of material renewal of the formative process which completes itself silently in the interior of the tissues.'[7]

" 'But the underlying reason,' says Dastre, 'of this interdependence between chemical destruction and function is made recognizable by energetics. A part of the organic material (reserve material, but also living protoplasm) becomes decomposed, chemically simplified, reduced to a lower degree of complexity, and abandons in this descent the chemical energy which it enclosed within it in the potential state.

" 'Every act which gives out energy, which produces

[7] Claude Bernard, *Leçons sur les phénomènes de la vie communs aux animaux et aux végétaux*, pp. 125-127; 157; 347-348.

heat, or movement, every manifestation whatever which can be regarded as a transformation of energy, necessarily consumes energy, and this is borrowed from the substances of the organism. The functioning of muscle produces heat and movement, the functioning of glands produces heat, the functioning of nerve and brain produces a small quantity of electricity and heat. All these manifestations of energy rest upon a destruction of organic matter, a chemical simplification as source of the energy manifested. In this way material destruction not only coincides with functional activity but is the measure and the expression of it.

" 'The reconstruction of protoplasm is on the contrary a phenomenon of evident synthesis, of a certain chemical increase of complexity, since this living protoplasm stands in a way at the highest stage of complexity. Its formation at the expense of simpler nutritive materials requires then an appreciable quantity of energy.

" 'The phenomena of living beings,' continues Dastre, 'may be divided into two categories. Some are intermittent, alternative and are produced or accentuated at certain times but can not be continuous. These are *functional processes.* There are others in which this property of sudden and intermittent expenditure of energy does not appear at all. They are in general *nutritive processes.* The muscle which contracts, functions. It has an activity and a repose. During this apparent repose one could not say that it was dead. It has life and this is here obscure in comparison with the manifest activity of the functional movement.

" 'The phenomena of functional activity are those which catch the eye and by which we are inclined to characterize life. These are conditional upon processes of consumption, of chemical simplification, of organic destruction through which energy is set free. And it is quite necessary that it should be so since these functional manifesta-

tions expend energy. These phenomena in which vital activities are most apparent are the least specific. They have only the character of general phenomena.

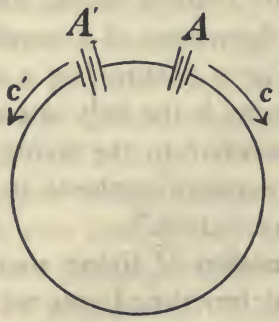
" 'The phenomena which accompany functional repose correspond to the reconstruction of the reserve materials destroyed in the preceding period, to organic synthesis. This remains in the words of Claude Bernard, "internal, silent, hidden in the expression of its nature, reassembling silently the materials to be expended. We never see these phenomena of organization directly. Only the histologist, the embryologist tracing the development of the element or of the living being notes the changes, the phases which discover to him this homely work, here a deposition of material, there the formation of a membrane or a nucleus, yonder a cleavage or a folding, or a renovation." This category of phenomena is the only one which has no direct analogues. It is peculiar to the living being and limited to it. This developmental synthesis is the true vital phenomenon. Life is a creation.'[8]

"This new formation of living matter which goes on during the so-called functional rest we must then seek to explain through the properties which we have postulated above for nervous energy taken as the basis of the vital phenomenon.

"For this purpose let us suppose in conformity with the hypothesis set forth above that one could construct an elementary electric accumulator capable of furnishing a single given intensity or specificity of current and that its electro-motive force or difference of potential between the poles is proportional to the mass of substance constituting its charge; as if each new increment however small of this mass constituted an element by itself which would be added in serial order to the others.

[8] Dastre, *La vie et la mort.* Paris: Flammarion, 1902, pp. 103, 107, 208-209, 210-211.

"Let us consider two of these accumulators, *A* and *A'*, inserted with their poles inverted in the same circuit. Suppose they are quite identical, except that the one, *A'*, is entirely without charge and the other, *A*, has its full charge. Let us suppose that the current, *c*, generated by *A* which tends to charge *A'* can under certain circumstances cause an oscillatory discharge, i. e., a continuous oscillation of the current, now in the direction of *c*, now in the contrary direction of *c'*, and that certain external alternating currents could induce in the oscillating circuit sinusoidal electro-motive forces of the same frequence as this oscillating discharge and thereby strengthen the sinu-



soidal electro-motive force of the latter which at the beginning was determined by the original difference in charge of the two accumulators *A* and *A'*.

"Then with each half oscillation the one accumulator will become more strongly charged in proportion as the other discharges, and there will be produced as final result a series of oscillations with a consequent continual increase of the total mass of the two accumulators *A* and *A'*, as long as the saline solution serving as their common aliment is not insufficient.

"If the amount of electro-motive force contributed by the induction current at each oscillation is proportional to the amount of electro-motive force which is directly de-

pendent upon the difference in charge between the two accumulators existing at any moment, if for example, it represents a definite fraction of the latter, and thereby will gradually decrease in amount as this difference between the two charges becomes less with each oscillation, then both the amount of this difference and that of the induced electro-motive force will sink to nothing after a certain period of time, theoretically infinitely long, practically more or less short, which we can call the period of reconstitution or of replacement of material consumed.

"As soon as the charges of the two accumulators have become equal there will exist no more provocation of oscillating currents and the total mass of the two accumulators whose increase had become always smaller and smaller will now not increase any further at all.

"But if at this instant either of the two accumulators suddenly becoming inserted aside from its own oscillating circuit at the same time *also* into one of the ordinary circuits, discharges into the latter wholly or partially, then the difference between the respective charges of the two accumulators will again be present and the former process of oscillation will begin again. And this will result again in the increase of the total mass of the two accumulators above the amount which it had already reached before this last discharge. We can compare this discharge of one of the two accumulators outside the circuit of oscillation, with the nervous discharge from the nucleus into its environment, that is, with the biological functional excitation which produces the same trophic effect.

"Further, if at the moment when the two accumulators have arrived at the condition of equality between their respective charges and so of repose, one of them, instead of becoming discharged into another circuit, becomes replaced by a third accumulator whose charge is different from the other two now equalized charges, the result will

be the same. And the impulse given to the process of oscillation will be greater, the greater the difference between the charge or electro-motive force of the new accumulator and of the old one replaced. In other words, to make use of biological expressions: the rejuvenescence of the specific potential elements formed by the pair of accumulators will be proportionally greater, the more quantitatively unequal are the two half elements which have become thus mutually fecundated.

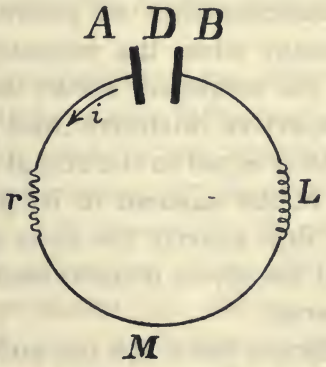
"If we substitute for the conception of electro-motive force that of nervo-motive force, our hypothesis concerning the nature of the vital process in each specific potential element or mnemonic element will consist simply in supposing that the latter is comparable to this pair of accumulators inserted with inverted poles in the same elemental oscillating circuit, which we would call intra-nuclear circuit, but in which there enters into play instead of the alternating electric induction current, general thermal energy in the same way.

"Assimilation, the new formation of living substance, would then be dependent, according to this hypothesis, upon a kind of rhythmic oscillatory charging and discharging flux, upon a kind of intra-nuclear oscillatory discharge which becomes induced by the extra-nuclear or functional nervous discharge in consequence of the disturbance of the equilibrium between the nervo-motive forces of the two accumulators opposite each other. The vital element would thus be conceived of as only a double specific elemental accumulator of nervous energy in continual charge and discharge.

"As will be noted we have here a phenomenon in some respects similar to the electric resonators of Hertz, in which an electric discharge caused by the difference of potential existing between the two armatures of a condenser, is transformed into an oscillating discharge. It

will be appropriate here to indicate briefly in just what this phenomenon consists.

"Let *A* and *B* be the armatures of a charged condenser which are suddenly connected with each other by an external conductor, *ArMLB,* in such a way that the latter makes a circuit open only at the point *D* of the di-electric. In the accompanying figure *r* represents the total resistance of the circuit and *L* the inductance or coefficient of self-induction of this circuit. When the capacity *c* of the condenser and the inductance *L* of the circuit are in a certain relation to each other, and *r* is *small,* we can get an oscillatory discharge which forms as it were a sinusoidal alter-



nating current: that is, the electricity oscillates from *A* toward *B* and from *B* toward *A,* with a frequency determined by the inductance *L* and the capacity *c.* If we cause the resistance *r* of the circuit to become constantly less by employing wires of constantly increasing thickness, we approach the boundary at which this oscillation will be able of itself to continue indefinitely.

"If in this case where *r* is very small, we excite in the circuit by induction sinusoidal alternating electro-motive forces of the same frequence as in the oscillatory discharge, then there will arise in *A* and *B* differences of very many volts even though the number of volts so induced be very small.

"Upon this principle depends, as is well known, the celebrated experiments of Hertz which in turn have formed the point of departure for wireless telegraphy.

"It is well known also that such an electric resonator has been rightly compared to a vibrating dynamic system, to a pendulum that has an oscillation time of its own, to a sounding chord which the smallest impulses having the same frequence as itself can set in vibration, even in strong vibration. What happens in it is a continual periodic transformation of energy. At the instant when the sinusoidal alternating current reaches its maximum intensity, one has the maximum of actual energy, while the condenser, on the other hand, possesses then no potential energy whatever. At the instant when the intensity of the current drops to nothing, the condenser shows the greatest deformation of the respective di-electric and possesses thus a potential energy fully equal to the actual energy possessed by the discharge at the moment of its greatest intensity, the process being thus exactly the same as in a pendulum in which potential energy is transformed continually into actual and *vice versa.*

"It will be sufficient here, for the purpose of a remote comparison, to note the fact just indicated, that an induced sinusoidal alternating electro-motive force in such an electric resonator, which need amount to only a very few volts, provided that it be of the same frequency as the oscillating discharge, will be able to induce in A and B differences of tension which may amount to many volts. For if we assume in the current so oscillating the faculty of depositing in each of the armatures of the condenser infinitely small particles of substance in series one after the other, until the total of their mass and the consequent electro-motive force surpass the electro-motive force in the opposite direction, which this current possesses at this point and at this moment, then it will not be diffi-

cult for us to understand the case in certain respects analogous, which we have assumed for the oscillating nervous discharges, in which the calorific oscillations which replace here the oscillations of the induction current continually increase the mass of living substance, which will in this way be 'assimilated.'

"Let us note that in the case of nervous currents we must assume that their specificity is constant even during the oscillation. At the same time, however, the duration of each nervous discharge, and hence of each oscillation also, in cases where the specificity i of the nervous current is something dynamically equivalent to the intensity of the electric current, must be definite and constant for every given specificity.

"For let us consider again an electric current. If its intensity i persists for a time t, the total actual energy furnished during the whole of this time by this current will be Eit, where E represents the electro-motive force. But this total energy will necessarily be proportional to the mass M of the substance whose decomposition during the time t has produced this current; one has thus $Eit = hm$, where h is a coefficient of proportionality, dependent solely upon the units of measure selected. But if the supposition which we have accepted for nervous currents in general holds good also for this electric current, namely, that the electro-motive force is proportional also to the mass of substance which tends by decomposition to produce the current, then also is $E = km$, where k again is a coefficient of proportionality dependent likewise solely upon the units of measure which are adopted. Consequently the above equation would take on the following form:

$$km.it = hm, \text{ that is,}$$
$$it = h/k = H,$$

where H again is another coefficient of proportionality and

dependent alone upon the units of measure already fixed above, that is, upon a selected, constant number. It follows from this, that *it* is constant. And if *i* in its turn is likewise constant for each specific current, *t* must also be constant; i. e., each definite specificity of current, *i* will correspond to a likewise determinate and constant period of discharge.

"If then, no matter what conditions the different discharges of a current of the specificity *i* may induce, all these discharges can have invariably only the same duration *t* and if this holds also for those which constitute the oscillating discharge, then the oscillation itself, which consists of a doubled discharge, of which each one has a direction contrary to that of the other as we stated above, will have necessarily a very definite and constant period of its own which corresponds each time to the particular specificity *i* of its respective current.

"It follows that of all the vibrations of the different calorific rays, only those which have the same oscillatory period as the element being reconstituted will be able to some extent to give to the oscillating discharge of the latter an impulse which will be added to that received through the difference in potential of the pair of accumulators, and thus to have identically the same effect as that which the sinusoidal electric alternating induction current has upon the electric accumulator with an equal period of vibration. And this becomes so much the more clear since Maxwell's theory, of which it is scarcely necessary to remind any one, and which was wholly confirmed by the Hertzian experiments, has demonstrated the essential identity of these electric induction oscillations across the di-electric formed by the air, with light and heat vibrations in general. The only difference consists in the period of vibration which in both the latter is much more rapid than in the former.

"Thermal energy then, whether that which comes from

the irradiation of the sun and from the outer world in general, or that which is developed from chemical processes of decomposition and oxidation taking place in the interior of the organism, would, in as far as it is composed of heat rays of the most different periods of oscillation, constitute the general external stimulus which actuates indifferently all vital processes whatever. Particular kinds of energy, which oscillatory periods varying within narrow limits and possibly even with a single vibratory period, such as the rays of each of the elemental colors of the solar spectrum would constitute on the other hand, special external stimuli which activate only the vital energies of this or that corresponding specificity.

EXPLANATION OF NUCLEAR SOMATIZATION.

"Therefore if we suppose a cell to exist whose nucleus contains at the same time various specific elements, each having a specific vibration period of its own, and if we assume that this cell is thenceforth always exposed to the same external stimulus with a constant vibration period, then among all the mnemonic elements, that one which is syntonic with this external stimulus will increase in mass since it absorbs always larger quantities of the nutritive fluid, and at the expense of all the other elements, so that in this way it may result that it supplant them all and remain the sole survivor. We may express this process by saying that the cell has undergone a complete nuclear somatization.

"Let us assume inversely that a cell whose nucleus contains one or several mnemonic elements is exposed at the same time as to the other stimuli, also to a new external stimulus, whose vibration period may differ from all those of the mnemonic elements already present. Then we can assume that this new vibration period may communicate its own frequency to one of the oscillating discharges al-

ready present and probably not to the whole nervous current constituting one of these discharges, but to only a part of it, i. e., it will make it syntonic with itself. The result will be the gradual deposition of a new specific substance or mnemonic element which, if this new external stimulus does not permanently displace all the others but co-exists or alternates with them, will merely add itself to the pre-existing. We may express this process by saying that the cell has experienced the influence of the new stimulus to which it has been exposed, or that it has experienced the 'imprint' of the new condition through which it has passed.

"It is the same thing if we say that instead of being exposed to a new external stimulus, having a rhythm different from all the preceding, the nucleus is constrained, in consequence of any given new functional adaptation on the part of itself or of its immediate environment, to divide some one of its specific currents into two or more components, or indeed, to receive some new specific current derived from the combination of other specific currents of the environment.

"In the circumstance that at each alteration of any period of oscillation or of any specificity of current through the action of a new stimulus, external or internal, there follows immediately the deposition of a new substance which adds itself to all the others already present and remaining unaltered, and which is capable of exciting only such currents as are syntonic or specifically identical with that by which it was itself deposited; in this circumstance the first and fundamental mnemonic process underlying all living substance would consist. From it would then spring directly all the other processes, from histologic differentiation and the inheritance of acquired characters up to mnemonic phenomena proper.

"Let us note that for each specific discharge, for the intra-nuclear oscillating as well as for the extra-nuclear

functional, there will correspond very definite substances of dissimilation, for the different specificities of the nervous currents can be due only to the decomposition of substances similarly different. And even if the diversity of these extremely complex and unstable substances consists only in the different number and different mode of grouping of the same atoms of the principal elements which constitute all organic substance, nevertheless the respective substances of dissimilation to which each of these complex substances will give rise, will necessarily be different from one another. These substances of dissimilation, definite and peculiar for each specific discharge, will in their turn afford, by their entire or partial oxidation, products of excretion and secretion quite definite and differing from one cell to another. These products, in their turn, thanks to their peculiar physico-chemical properties, will impress upon the protoplasm or cytoplasm a corresponding physico-chemical character. And as at the same time the deposition and the arrangement of these materials in the body of the cell is a consequence, in part of the physico-chemical properties inherent in them, in part of the paths, which the respective extra-nuclear nervous discharges or currents will have followed in the cytoplasm according to their specificity, so it is conceivable how the *ensemble* of the mnemonic elements constituting a given nucleus can determine its own protoplasm or cytoplasm both from the purely physico-chemical and from the properly morphological point of view.

"We arrive thus at a constant double correlation between the cytoplasm, the species of nuclear excitation and the substance of the nucleus. The nuclear substance, in fact will determine at once the rhythm of charge and discharge, and the specificity of the corresponding nervous current; and this specificity of current, thanks to the substances of dissimilation to which it will give rise, will de-

termine the respective cytoplasm. Conversely, the rhythm, once it is modified by the functional stimulus, will immediately induce the corresponding modification of the specificity of current; and the latter in its turn will at once determine the substance of synthetization or nuclear substance, as also the substances of dissimilation of which the cytoplasm is constituted.

"It is not excluded either that chemical substances which may act upon the cytoplasm and modify it chemically can facilitate the formation of such or such substances of dissimilation and thus facilitate the production of such or such new specificities of currents which in their turn will deposit or determine the respective nuclear substance. In other words, we do not exclude that besides the physical functional stimuli which preferably influence the vital rhythm directly, there may also exist chemical functional stimuli, which act directly, rather upon the nervous specificity. But thanks to the close correlation between the specificity and the rhythm of these currents, both come to the same result, namely that each contributes its respective mnemonic element to the nuclear substance."

(Pp. 319-320): "Let us note, parenthetically, that nuclear somatization conceded, we must regard each of the substances which make up the different specific potential elements of any nucleus as capable of gradually replacing the others by continual increase of its mass, when the respective specific current, on account of the incessant repetition always of only one and the same stimulus passes very frequently through the nucleus. A nucleus thus somatized,—that is to say, one composed wholly of a single specific substance and which would acquire in this way, on account of the considerable mass of this substance a potential energy capable of overcoming a considerable resistance to its discharge, will then be able to respond to stimulus always in that single way only which corresponds

to the single specific nervous current which it is able to activate and which constitutes its irritability, even if it be provoked to discharge by external influences or accidental stimuli which are quite different from those to which it is ordinarily exposed. 'A muscle cell,' says Oscar Hertwig, 'replies to every kind of stimulus by contraction, a gland cell by secretion; an optic nerve can perceive only light, no matter whether it be stimulated by light waves, by electricity or by pressure. Similarly plant cells also are endowed with their own specific energies: the reaction to stimulation receives everywhere its specific stamp from the particular structure of the irritable substance, or in other words, irritability is a fundamental property of living protoplasm, but under the action of the environment manifests itself in specific reactions according to the structure of that protoplasm.' "[9]

Resuming again (pp. 377 ff.): "Let us summarize what has been said. The specific potential elements which have presented themselves above as specific elementary accumulators, and as mnemonic elements, appear now as specific vital elements, that is, as the smallest possible particles of organic substance capable of life. At the same time the denominations *potential* element and *vital* element, which might at first have appeared incompatible with each other, if the adjective *potential* had indicated a vital nonactivity at that time, become entirely compatible in consequence of the hypothesis which we have just set forth. According to this hypothesis, the element would be potential in so far as each of the two coupled accumulators would be able to furnish at need its proper extra-nuclear functional nervous discharge; and it would at the same time he conceived as in a *vital* process by reason of the intra-nuclear oscillating discharge, which continues incessantly between the two accumulators. Vital energy could thus present itself

[9] Oscar Hertwig, *Die Zelle und die Gewebe*, I, p. 76.

in three distinct modes: (1) In the potential, properly so called, which expresses itself in the phenomena of effective suspension of life or lethargy in its widest sense; (2) In the oscillatory potential, or the intra-nuclear oscillating discharge, which constitutes the essence of the period of so-called 'functional repose,' 'organic reconstitution,' 'storage of materials afterwards to be consumed,' 'assimilative synthesis,' or 'vital creation'; (3) Finally in the actual proper, or the extra-nuclear non-oscillating discharge, which constitutes the period of 'excitation,' 'functional activity,' 'wear and tear,' 'consumption of material stored up in the rest period,' 'disassimilation,' or 'vital destruction.'

"In this way, the fact upon which Dastre rightly insists, that 'after the explosive destruction of a chemical reserve,' constituting the functional activity, the living substance still always preserves in the state of repose which succeeds the same properties though attenuated, which it manifested in the state of activity, would find an immediate explanation. Hence the period of repose cannot be of another nature than that of the state of activity as Claude Bernard was inclined to think. 'To-day,' writes Dastre, 'if we had to express a more personal opinion upon this important distinction of functional activity and functional repose, we should say that, after having distinguished the two categories of phenomena it is necessary to try to bring them together. It is necessary, for example, to seek what there is in common between the muscle in repose, and the muscle in contraction, and to perceive in the muscular tonus a sort of bridge thrown between the two conditions. The function would experience no interruption, but it would have its degrees. The muscular tonus would be the permanent condition of an activity which is merely susceptible of being considerably heightened or weakened.'[10]

[10] Dastre, *La vie et la mort*, p. 212.

"As conclusion of our exposition let us note very briefly that for three more of the most fundamental phenomena associated with vital activity this hypothesis upon the nature of life presents at least the beginning of an explanation. These are: rhythmicity, a characteristic property of all life phenomena; the phenomena of fecundation and rejuvenescence in general; and nuclear division with all its characteristic and remarkable details.

EXPLANATION OF RHYTHMICITY OR PERIODICITY.

"A whole series of facts forces us to the opinion, that rhythmicity should be reckoned among the most general characteristics of the modes of manifestation of vital energy. Beyond the fact that nearly all, and perhaps all external physical stimuli, from the thermal and luminous to the acoustic are characterized by vibrations; and beyond the other fact, a consequence of the first, of the physiological action exercised by musical rhythms and intervals for example, and by all the rhythmical manifestations of the most diverse energies, we see that a more or less manifest and more or less regular periodicity is a fundamental character of all or nearly all biological functions. One thinks at once for example of the synchronous rhythm of all the peristomal cilia of an infusorian—a rhythm which manifests itself in the two parts of an animal which has been divided, provided these parts remain connected by a bridge of protoplasm; of the rhythmicity present in the protozoa in general, present even within the cells in the pulsation of contractile vacuoles, which empty and refill themselves continually at regular intervals; of the beat of the heart, even independent of its connection with the nervous system; of the similar pulsations of the whole vascular system, the entire breathing apparatus, the uterus, and of many other organs; and finally of the periodicity of a whole series of physiological variations, which animals and plants

undergo as a result of corresponding periodical variations of the outer world, but which persist unaltered for some time even when the outer world or the periodicity of its variations may have changed.

"Now it is not difficult to conceive of this rhythmicity or periodicity which nearly all biological functions present, as a consequence more or less direct or indirect of the vital phenomenon in all its generality, when this phenomenon, be it only in so far as a phenomenon of assimilation, is itself essentially a rhythmic phenomenon.

EXPLANATION OF FECUNDATION.

"In regard to fecundation we know that it was Spencer who first recognized what has been more or less explicitly accepted by others, that it consisted probably in a purturbation of an equilibrium which tended toward a stability unfavorable to vital activity.[11]

"Now we have already seen how our hypothesis set forth above is able to make at once conceivable in what this equilibrium unfavorable to vital activity may consist. According to this hypothesis, it would consist in the equalization toward which the masses, and the corresponding potentials, of the coupled accumulators of each mnemonic element would tend and which they would eventually attain, and this equilibrium would be disturbed by the substitution for one of these accumulators of another specifically equal to it but differing in mass and potential. And it is precisely in this function of fecundation, of replacing in each couple one of the specific accumulators by another differing quantitatively as widely as possible that we find an explanation of the fact that the rejuvenation of the germ and the consequent vitality of the progeny to which fecundation tends, are proportionally greater when fecundation occurs not between individuals too closely alike, but

[11] Spencer, *Principles of Biology*, I. pp. 340-341; II, pp. 614-616.

rather between individuals who belong indeed to the same species but are somewhat dissimilar.

"According to the same hypothesis, this equilibrium could also be deranged by the extra-nuclear discharge of one of the two coupled accumulators, and this is just what is demonstrated by the universally known experiments upon the rejuvenescence of the infusoria, by which it appears that this rejuvenescence can be reacquired even without any need of the ordinary fecundating conjugation, simply by causing some change in the surrounding conditions of life, and thereby provoking a strong renewal of the functional activity.[12]

"Let us note parenthetically that if oscillating discharges take place between the corresponding separated specific accumulators or half mnemonic elements of the egg and spermatozoon respectively even when the egg and spermatozoon are still relatively distant from each other, i. e., before they could coalesce into a single fecundated nucleus, we can then understand how the space between each pair of these elements can and must function just as the deformed dielectric between the two armatures of the condenser of the electric resonator, and thus be constrained to produce the attraction of each spermatic half element to the corresponding half element of the ovum. And this would have as a final result an energetic reciprocal attraction between the ovum and the spermatozoon.

"The real cause of the sexual attraction of the two germs, male and female, would then reside in their capacity of *vibrating in unison*. Conversely, the absence of all attraction between ovum and spermatozoon belonging to animal or vegetable species distantly related would be due to the fact that they would represent potential half elements, of which there would be too great a number, for

[12] Hartog, "Problems of Reproduction, etc." *Contemporary Review,* July, 1892, esp. pp. 94-95, 100-102.

example in the spermatozoon, completely different specifically from those of the egg, and they could not possibly, therefore, have the same rhythmicity.

EXPLANATION OF KARYOKINETIC CELL DIVISION.

"As to indirect or karyokinetic cell division, let us note that, when each of the two coupled accumulators, in consequence of the continual increase of its mass attains too high a potential, the two halves of each of these accumulators will tend to repel each other, just as would, for example, the two halves of a conducting sphere or disc, charged with too great a quantity of static electricity of the same sign.

"If we admit at the same time, that the separation of the two halves of each accumulator would break abruptly the circuit of oscillation, as would seem indicated by the rupture, retraction, and disappearance of the meshes of the nuclear reticulum during mitosis, and thus suspend temporarily the oscillating discharge, then the nervous energy of this discharge being still at that instant in a dynamic state along the same circuit of oscillation will remain no longer actual energy, but on the contrary becomes transformed into potential, and discharge itself upon the first little bit of substance most capable of receiving it. And this substance, likewise, when once charged with static nervous energy of the same sign must divide also into two parts and thus must form two distinct centers of attraction which mutually repel each other. Consequently, without pretending thus to be able to penetrate into the smallest details of this phenomenon, we understand nevertheless how vital phenomena of *dynamic* order, which are due to the oscillating nervous discharge, must then necessarily be followed by phenomena of *static* order, quite similar to the corresponding phenomenon which the oscillating discharge of an electric resonator would offer, if its oscilla-

tion being suddenly interrupted it discharged itself straightway upon any heap of conductive metallic filings which it encountered, transforming itself from dynamic to static electricity.

"This view would find support especially:

"1. In Delage's observation that in indirect division the longitudinal splitting of the chromosomes or of the nuclear filament begins before achromatic filaments are present which are capable of exerting upon them any pull whatever, from which it may be inferred that it is repulsion which operates between the two halves;[13]

"2. In Hansemann's observation, that during karyokinesis all the peculiarly vital functions of the cell, as assimilation, secretion, etc., are completely suspended;[14]

"3. In Watase's observation, according to which the centrosome in reality is only a simple cytomicrosome but of greater circumference and greater force of attraction, and that the cytomicrosomes which always lie at the meeting point of three or more cytoplasmic fibres, likewise are nothing else than small clumps once quite aspecific which form anew in each cell division and from which arises the contractile substance of the cytoplasmic fibres themselves;[15]

"4. In Ziegler's experiment, in which the poles of the horse-shoe magnet took the place of centrosomes and acted upon iron dust strewn upon a thin horizontal wax plate upon which previously pieces of iron wire of forms similar to that of the chromosomes had been placed, and in which figures were obtained which were quite similar to those presented in nuclear division, which is a direct proof of the conception already advanced by Roux, that in the attraction exerted by the centrosomes upon the chromo-

[13] Delage, *De l'hérédité* etc., pp. 149-150.

[14] Hansemann, *Studien über die Spezifizität, den Altruismus und die Anaplasie der Zellen,* p. 10.

[15] Watase, *On the Nature of Cell-organization,* Boston, Ginn, 1894, pp. 92-93; and *Origin of Centrosomes,* Ginn, 1896, pp. 282, 285.

somes there are in play static energies of nature similar to that of magnetic force or of static electricity."[16]

The hypothesis which Rignano suggests seems, then, to show how very many of the characteristic phenomena of living beings may be scientifically explained. It is a simple hypothesis, based directly upon properties of physical energy which are well understood. The additional specific properties which it attributes to vital energy, seem to be quite in accord with the properties of physical energy so far as they are known, and to be such as they might, under certain conditions, be expected to present, seem also to be very directly indicated by certain biological processes, especially by memory and ontogeny.

The great reason why it must be very seriously considered, lies in the fact that it explains so much which heretofore has seemed beyond the reach of explanation or even of speculation. Assimilation, rhythmicity and periodicity, mitotic division of cells, fecundation, memory, ontogeny with its orderly repetition of ancestral forms, heredity—these phenomena, the most fundamental and constant of all those manifested by living things, have been just those most difficult to explain. Biological details have been thoroughly worked over. The vast store of observations upon them, and upon the modes of action of the fundamental vital processes, constitute the science of biology to-day, but upon the essential nature of the productive cause of all the varied phenomena of life, biology is relatively silent. The problem has been so difficult that by many it has been hopelessly abandoned, though surely hints of the solution must come up before us constantly in our daily work, if we could but understand them.

[16] Ziegler, "Untersuchungen über die Zellteilung," *Verhandl. der deutschen zoologischen Gesellschaft,* Leipsic, 1895, pp. 78-83. Roux, *Ueber die Bedeutung der Kernteilungsfiguren,* Leipsic, Engelmann, 1883, p. 18.—Marcus Hartog, "The Dual Force of the Dividing Cell, Pt. I: The Achromatic Spindle Figure Illustrated by Magnetic Chains of Force," *Proceedings of the Royal Society,* B, Vol. 76, 1905, esp. pp. 555-559.

Some have referred the vital process to the action of spirit, shelving the problem in so far as science is concerned as unreachable and unknowable. But its study constitutes, as Rignano truly says, the real end and aim of all biological study, none of which is without direct relation to it. The conceptions of a few great naturalists have been beacon lights, guiding the course of others, but the fundamental causes are still in darkness. These causes must be sought in the borderland between physical science and biology, and here the help of the physicist is valuable and indispensable, especially if like Rignano, he is able to see clearly in what the fundamental problems of biology consist, and is able also to think synthetically.

The hypothesis contributes to science a basis and guide for further constructive thought and work, and as such cannot fail to fulfil the modest hope of the author that it might be a *travail d'approche* toward true conceptions. And as such it is being gratefully received and carefully considered by many who are still hopeful that these things also will be clearly seen and understood.

Rignano concludes his book by saying that he will be especially grateful to those biologists who will be so good as to send him criticisms or objections, and also to advise him of new facts which can be adduced either for or against his conception.

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MONTGOMERY'S PHILOSOPHY OF VITAL ORGANIZATION.

A MONISTIC philosophy that finds idealism and materialism alike inadequate as interpretations of nature, and which essays to shift the entire epistemological structure upon a new and naturalistic foundation is offered by Edmund Montgomery in his latest, and perhaps final, utterance, *Philosophical Problems in the Light of Vital Organization.* (G. P. Putnam's Sons, New York and London.)

An ontography is here formulated which will go far, its venerable author hopes, to recover philosophy from its forlorn driftings on the unpathed and harborless seas of metaphysics. He beckons back the thought from its wanderings in these intellectual infinitudes, and bids it find in the most intimate and familiar of all things, the human organism, with its phylogenetically developed memory and conscious content, the veritable harbor of ultimate knowledge. Philosophy, he asserts, must reach its truths through physiological and not through speculative investigations.

Such an hypothesis, because of its revolutionary character, can scarcely fail of securing the attention of those whose thought is devoted to either scientific or philosophical interpretation.

Montgomery has covered wide reaches of speculation. Gathering data from the four corners of the philosophic firmament, he has focalized his findings in the individual

microcosm, declaring that in the human organism are to be found, wrought by vital interaction with its surrounding medium, such neural refinements of the ectodermic structures as to harbor all the initiating marvels of man's mentality. "Solely through close attentive investigation of what is revealed in perceptual awareness regarding the organism and its functions," says Montgomery, "can be gained an understanding as to how the living substance or organism comes to be alive, by what means it has structurally and functionally developed so as to stand in definite, manifold interactive relations to its medium, and which of its structures and functions are concerned in the harboring and issuing of its conscious content, in the acquisition of its accumulating and latently preserved experience, and its conduct of life through guidance of such gathered experience." (*Philosophical Problems* etc., page 329.)

With rare dialectic skill, and with an array of all known pertinent facts of physiology, to which he has superadded much valuable data as result of personal, scientifically conducted investigation along biological lines, he essays to demonstrate that there is a veritable physiological seat or source of those potential efficiencies which, stimulated into activity, resuscitate our evanished, though latently enduring experiences imprisoned in the silence and the glooms of the subconscious. Are we, indeed, to hope that science will yet trace the processes which vitally alchemize within the mysterious plexus of the living structure the fleeting phantasmagoria of conscious states, and organize them into the synthetized bodies of conceptual knowledge which we denominate reason with its "universal principles," its "categories," its "ethical imperatives," its "*a priori* mathematics," its "logical norms"?

Adopting the basic postulate of idealism, Montgomery recognizes consciousness as our only direct source of per-

ceptual and conceptual revelation: sense-effected on its objective sides, there is revealed, albeit only symbolically, a universe of abiding, though everchanging, sense-stimulating, substantial efficiencies. Upon its subjective facets arise memories, concepts, volitions, emotions and all the deliverances of our apperceptive faculties.

The forcelessness and purely subservient character of consciousness is strenuously insisted upon, it having, he maintains, "no other significance than to render the living being aware of his organically ingrained modes of interrelation with that which constitutes its real extraconscious environment."

But here, let it be said, the reader loses the very essence of Montgomery's thought if he permits himself for a moment to forget that, to our author, the great extraconscious, perception-compelling entity which we call the external world, including our own being, is only vicariously known to us. What consciousness presents as perceptual realities are fashioned from the radiated influences of force-endowed existents subsisting outside mind, and translated into mental simulacra by means of the functional activities of brain and specialized nerve-structures, themselves the developed creatures of this interplay.

But Montgomery's world is not the world of the idealist, for to him a not-I assuredly exists, though only emblematically revealed. To this contention many a paragraph of his writings is devoted. "*Perceptual* mind," he says, "is altogether moulded on the foreign powers which appear to us as the outside world, and has therefore no meaning save in relation to those outside powers. *Conceptual* mind, in its turn, is significative of those perceptual realizations, and has no value but in reference to them, and the natural and genuine field of exertion for our will, its objects of desire and aversion, lie likewise in the world of foreign existents outside our individual mind. Thus not

only our bodily organization but our entire mental constitution is fashioned in correspondence to a complex world external to our own being." (*The Index,* Oct. 9, 1884.)

Thus unequivocally does Montgomery exclude from his neo-vitalistic credendum all implications of transcendental endowments miraculously infused into the organism. With kaleidoscopic shiftings of the tenets of idealism, he attacks them from every conceivable viewpoint, while materialism suffers no less vigorous assaults from his dialectic "big stick."

It has been one of Montgomery's chief endeavors to demonstrate the unity of the organic individual, and thus to controvert the dominant theory of biologists, which maintains that all organisms, vegetal and animal, are animated not by the vitality of a unitary protoplasmic substance, but by a plexure or aggregation of more or less autonomous elementary cells, plastidules, micellae, gemmules, pangenes, biaphores, physiological units, or whatnots,—not by an indiscerptible plasmogenic being, but by morphological units, almost undifferentiated, working with hyperintellectual endowments to execute the interdependent functions of a complicated living structure.

In short, Montgomery contends for a panzoism that regards the organic being as bioplasmically unitary—a synplasm, and a quasi "entellechy," possessing "the inherent activities of agencies specifically operative in the production of all vital phenomena." He undertakes to demonstrate scientifically and epistemologically that consciousness and all psychic exhibits whatever are dependent upon specific conditions of the vital organism as wrought by interaction with its environment through ages upon ages of vital toil and adjustment.

These specific, synthetized neural congeries possess, he asserts, the intrinsic, though phylogenetically acquired, properties which actuate the faculty of developed aware-

ness, and condition its deliverances by referring them to the mnemonic thesaurus of the subconscious. He finds also in this "intraconscious, microcosmic world," with its marvelous self-reintegrative efficiencies, an answer to the ancient enigma of identity amid change, and a solution of the perennial problem of substantiality. In this same protoplasmic substance, structured functionally into persistent organization, he detects "the abiding matrix that harbors within its trans-phenomenal, extra-conscious recesses accruing experiences, as memorized and systematized knowledge."

Thus, in the specialized sentiencies of the vital organism, and as a result of its physiophyly, appears that psychic radium whose mutating identity, ever renewing, ever disintegrating, radiates all mental activities, re-absorbing each fleeting mode of consciousness, and, touching it with the immortalizing alchemy of memory, relegates it to the under-world where abides the "ingathered Past"—the great Subconscious, to whose marvelous functions Montgomery, more than any other philosopher, assigns the vast importance attaching to them as data of a correct epistemology.

Reason, he says, is inseparable from socially acquired language, so that, with all its manifold deliverances, instead of being a world-creating entity or demiurge, as proclaimed by idealists, it is assumed to be a forceless by-product of perceptual activity and sensorial elaboration, wrought through age-long social and linguistic association, and not an *ab extra* creative importation from transcendental realms, projected through an undiscoverable mystical medium.

This, in its boldest and most sensational features, presents the work to which Montgomery has devoted a long life of patient toil. As this article, by editorial request, is to incorporate somewhat more of the personal element

than is usual in *The Monist's* reviews of philosophic works, something should be said of Montgomery's unique literary style, a feature which elicits either the ban or the enthusiasm of the reader, according to his temperament.

In Montgomery's mental processes there is neither hiatus nor elision. His very coherency subjects him to the charge of over-elaboration. His intellect possesses a sort of alkahestic quality. No composite entity but breaks under his mental catalysis, and his sense of continuity seems to dissuade him from dissipating his thought into such grammatical individualities as sentences, for he ramifies his theme with clause after clause, in bewildering profusion, till a sentence extends sometimes through a score or more lines of his book, and mental continuity well-nigh exhausts itself in wending the verbal causeway he throws across his thought.

His diction is essentially poetic, because, with trenchant insight, he explores the very soul of his thought, and because he adopts purely literary forms of expression, even paraphrasing technical terms wherever possible, thus incidentally rendering philosophy a unique service. In the elucidation of his own theories he has practically developed a special Onomatology.

There is thrilling suggestiveness in some passages of Montgomery's writings as they dart their illumination over uncharted reaches of nescience or into murky nooks of nature's arcana. This is because to Montgomery nothing seems conventional or familiar. He stands before his thought with an awe and intellectual alertness such as Plato ascribes to his imagined cave-creature, who, reared in subterranean glooms, was nurtured to intellectual maturity, emotional normality and sensorial completeness, then led forth to behold for the first time the splendors of a sunrise. There are instances, it is true, in which Montgomery seems to literally revel in linguistic intoxi-

cation; but an attempt to reduce the thought to greater verbal sobriety would result in disappointment. Professor James in a late *Hibbert Journal* has said of Hegel: "His passion for the slip-shod in the way of sentence; his unprincipled playing fast and loose with terms; his abominable vocabulary, calling what completes a thing its negative, for example; his systematic refusal to let you know whether he is talking logic or physics or psychology; his deliberately adopted ambiguity and vagueness, in short, make his present-day readers tear their hair out in desperation." Contrast this intellectual insincerity of Hegel with the intensity and propagandic vehemence of Montgomery, and we find at once the cause and justification of his affluent utterance. Idiosyncrasies and mannerisms of expression are not lacking, but these are easily mastered.

His subtle and intuitive grasp upon the salient features of a philosophy or school of thought is notable. In the alembic of his mind the essential components of a theory loosen from their superadded composition and move, almost with the accuracy of chemical affinity, into their proper places in his conception. An illustration of this faculty will be found on page 101 of his *Philosophical Problems*, where he specifies the dialectic subterfuges and fantastic subtleties to which philosophers have been driven in efforts to square their postulates with the psycho-physical entanglements presented by the interaction of body and mind.

In the year 1852 Montgomery matriculated at Heidelberg as a medical student. His range of acquaintance even then included many of the representative thinkers of Germany, association with whom, owing to their conflicting views, served to thrust our young student into a bewildering vortex of world-interpretations. Under the sway of Moleschott and Vogt, medical science was being delivered mainly in terms of materialism, these eminent teachers

having recently disavowed the conceptual vagaries of Oken and Schelling. But the enthusiastic exposition of Fichtean phenomenalism and of Hegelian ontology as proclaimed by his friends Christian Kapp and Kuno Fischer almost diverted our student from the philosophical faith dominant amongst the expounders of his chosen science. As a counter-check to his idealism, extended conferences were held with the celebrated Ludwig Feuerbach, who, after renouncing Hegel's solipsism, had become an ardent believer in the real existence of sense-revealed perceptible nature. Already Montgomery had read Schopenhauer, and remembered his remark that materialism was fit only for barber apprentices and apothecary assistants, a view gleefully endorsed by most of Montgomery's philosophical friends. But ever the old psychophysical riddle haunted his thought. If no kind of matter can produce or secrete thought, how is it, conversely, possible for any kind of thought to produce matter? The existence of the body is quite as certain as is that of mind. Can they be one and the same entity? Is this tangible and visible body the external aspect of the same existent that reveals itself in intangible and invisible modes of mental awareness?

Experience in the dissecting-room at Heidelberg forbade assent to this theory. The bodily structure remained before him concrete and visible in all its features. The mind, however, had departed, or rather had become wholly extinguished. Mind, therefore, must be something radically different from body. His medical tutors assured him that the body consists wholly of inert material particles mechanically moved. This being true, is there not a wide and essential disparity between it and mind? Nevertheless their interaction was undeniable, though a feeling, thinking mind could not be conceived of detachable from a body in which it had come into the world, and with which it had correspondingly developed from infancy to

maturity. Are then the manifestations of mind and the activities of the body, being experienced as inseparable, concomitant and complemental, to be regarded as only different modes of one and the same entity or individuated being?

Descartes had introduced into biology the prevailing mechanistic and materialistic views of vital processes, and shortly after Montgomery's school days Dubois Reymond and Huxley demonstrated conclusively that mind and mental phenomena only ineffectively accompany the body's mechanically-moved activities without having the least influence upon them. About that time the famous dictum was formulated declaring that brain secretes thought as the liver secretes bile. Physiologists were also proclaiming that thought is accompanied with cerebro-molecular agitation, and the world's best intellects were engaged upon the problem of how the constant and manifold intercommunication of two such incommensurable entities as mind and matter is effected.

The occasionalism of the Cartesians; the absolute, all-involving Substance of Spinoza; the Preestablished Harmony of Leibnitz, and other equally fanciful hypotheses were then engaging the serious thought of philosophers. Descartes had bisected nature into two substances, an unextended thinking substance, and an extended material substance. Intercommunication between two such disparate entities was, however, utterly unthinkable, for how can an unextended substance enter into intercommunication with a spatially-divided or extended entity? Besides there is nothing more surely extended in the world than perceptual vision; yet this is a manifestation of the very entity which is declared to be unextended.

In positing his Absolute Substance, Spinoza failed to disclose any reason why the order of thought should correspond or be identical with the order of things. The

Preestablished Harmony of Leibnitz seems too fantastic to justify even an analysis in this day of severe thought. His "two-clock" conceit serves only to loosen the brow into smiles. Body and mind actually do work in harmony, and the harmony is preestablished, following from the first prenatal movement till death brings a period to vital manifestations. But in all these philosophic postulates there is not a scintilla of explanation given as to how the harmony was established and how it accomplished its results. Primordial fatality or divine fiat were the alternative answers open to the interpreters of these irrational speculations.

The world-creating power of mind, exerted as will or thought, was, in these early days of Montgomery's scientific studies, receiving more serious consideration than was any materialistic view. Kantian transcendental conceptualism, Hegelian ontology, Fichtean solipsistic idealism, Berkeleyan non-substantialism, with their scores of derivatives and interpretations, were rife in the philosophic realm. "Concepts were declared to be the real enduring entities in the world, the abiding archetypes, or comprehensive universals, of which all other modes of existence are mere perishing copies or particulars." (*Philosophical Problems,* etc., page 20.) But Montgomery detected no creative power in his own will or thought, nor in that of any of the idealistic expounders of conceptual potentiality. The radical difference of nature obtaining between the generally perceptible universe and the world of exclusive subjective awareness constantly thrust itself upon his thought.

At Bonn Montgomery attended the lectures of Helmholtz on the physiology of the senses, at which time Berkeley's theory of vision was discussed, and Montgomery was led to read other works of the great idealist who, as he wrote later, "extended the domain of consciousness by despoiling physical nature of all perceived qualities what-

ever, proving that every thing which is realized as perception is of necessity a mental phenomenon." Previously Locke had demonstrated that colors, sounds, odors and tastes were subjective or conscious phenomena and not properties of external existence. Kant had reasoned time and space into mere modes of thought. "After such complete draining into the sphere of consciousness of everything which seemed to make up physical nature, it became doubtful to philosophically trained minds," says Montgomery, "whether there exists, in truth, anything in the world save consciousness itself." But unlike our Huxleys and our Tyndalls who eventually took refuge in idealism, being unable to solve the psychophysical riddles of being, Montgomery made his escape, figuratively speaking, through the back door; for, pondering on the respective parts body and mind are playing in seeing and hearing and in sense-perception in general, he realized that if everything which appears perceptually is of ideal and not of material consistency, then, conversely, it must also be true that nothing mental can be itself perceptible.

And here, indeed, is the very pith of Montgomery's world-conception and interpretation. With almost tiresome iteration, the classification of the perceptual and the conceptual is presented to the reader's attention. If we really consist of mind-stuff, is his contention, we should be wholly imperceptible to others, indeed wholly non-existent. We cannot perceive, touch or see another person's feelings, thoughts or emotions; but we can see and touch another's body. What we actually perceive as another body, though itself a mere mental percept, must evidently represent something of a nature entirely different from that of its perceptual image within the percipient's conscious content.

This sense-hidden mental awareness has to be communicated to outsiders by means of bodily or tangible

signs through sounds, sights or gestures. And the meaning of these signs must be interpreted by the observer's own connatural experience. That which, through sense-stimulation, arouses in beholders a definite percept is characterized by Montgomery as a "power-endowed, relatively permanent entity," while the aroused percept within the conscious content is itself only a feature of "the panoramic play of our fleeting modes of awareness"—a forceless, evanescent ideal phenomenon. The former has power to affect the senses in definite ways, and is hence called "physical" in radical contradistinction to the forceless mental state called "psychical." In this light, Montgomery thinks the problem of psychophysical parallelism becomes intelligible: the mental awareness forms the psychical half, while the observer's sense-imparted perception can be regarded as the physical half of the parallelism. But it must be observed that the same vital process which awakens in the subject a definite mental phenomenon, and elicits corresponding physical expression, evokes through sense-stimulation, in the beholder, accordant motor signs. The perceptual awareness of these physical tokens is just as much a mental state as is the subject's imperceptible ideal phenomenon. The term "physical," then, in this connection, means the external, sense-compelling influence which affects in definite, preestablished ways the beholder's receptive sensibilities, and forces the presence, characteristics and activities of its source of emanation to reveal themselves in mental representation.

It must be remembered that in Montgomery's epistemological system, everything is trans-phenomenal except awareness and the actual content of consciousness, present or memorized. Hence all activities that can cause conscious states to arise, whether of the perceptual or conceptual order must be regarded as extra-mental, that is, external and physical. He says (*Philosophical Problems,* etc.,

page 145): "These extra-conscious activities, resulting in mental occurrences, are set going in the same power-endowed sphere wherein our enduring self and its matrix of consciousness have their real being. These specific activities of the organic being are, consequently, as such, unknown processes, processes taking place outside conscious awareness. They are, however, definitely signalized by the specific conscious state to which they respectively give rise." And that which evoked the conscious state is henceforth preserved to reissue its efficiency as a memory upon appropriate stimulation, all this occurring in the organic realm beyond any possible control of consciousness, which indeed is only the interpretative outcome of these processes. And this is also the explanation of the phenomenon of volition or self-determination, a subject to which Montgomery devotes much attention.

Sense-stimulated awareness is strictly compulsory. Its content cannot in substance be volitionally changed. But there is another set of mental phenomena more intimate than that revealed by physical stimuli: it is the realm of past experience systematized and memorized. This submerged world can reappear in consciousness independent of sense-incitement. Sense-awakened mental states, however, cannot appear without carrying with them, or, perhaps, more correctly, concomitantly eliciting, as interpreters, a wealth of complemental data from memorized past experience. And this is one of the most remarkable facts of psychic life. Some synthetizing property, doubtless having its basis in neural or cephalic structure, appears to be a function of the organism, as is regeneration. Somewhere and somehow within the recesses of the encephalon this synthetizing function is ever carrying on its wonderful processes, and returning its product in systematized and therefore available memory of affiliated past experiences.

The transference of epistemological problems from the

realm of metaphysics to the domain of biology was first essayed by Montgomery in discussions with Helmholtz, and somewhat later advanced in a German work entitled *Die Kant'sche Erkenntnisslehre widerlegt vom Standpunkt der Empirie.* This rather elaborate attack on Kant's doctrine of the *a priori* bore the subtitle, *Ein vorbereitender Beitrag zur Begründung einer physiologischen Naturauffassung,* and one of the chapters carried the rather startling title: "The Necessary Synthesis of the Sensible Manifold is a Physiological and not a Logical Action." The following passage from that work gives, perhaps, the earliest enunciation of a philosophy based upon vital organization: "The solution of philosophical problems is to be found only by way of physiological investigation. Every philosophical question, rightly put, is a physiological question. We know that an organ repairs the waste it suffers in functioning; that it restores itself to a state identical with its former self without being assisted thereat by anything mental. Thus it becomes unconsciously capacitated to perform anew identical functions. It is this entirely organic process which underlies all consciousness of identity, and certainly no spontaneous power of the transcendental Ego, as assumed by Kant." (Pages 125-6.)

Another fact of nature which in Montgomery's philosophy is deemed of paramount importance, is that actual awareness takes place only in the real present, a mode of time radically contradistinguished from the future and the past. These present moments of awareness follow each other uninterruptedly, passing away in "dissolving waves of ever-lapsing Time," as Montgomery poetically says. If the evanescent content of past moments of awareness were not available to present consciousness, complete oblivion of everything previously experienced would prevail. As the content of these past moments of awareness cannot possibly dwell in the transitory panorama of the conscious

phenomena themselves, there must, perforce, be some matrix wherein their memory is enduringly preserved. "Time itself cannot be apprehended, only its freight of succeeding appearances is the object of apprehension. These appearances supplant each other successively. And their definite sequence in time must, then, evidently be necessitated by the definite activity of the underlying substance which issues them into actual awareness. They, therefore, necessarily appear in definite order in subjective or empirical apprehension, because they are thus definitely determined in the realm of substantial existence." And this interrelated, persistent, substantial entity, this extra-mental, power-endowed sphere of real existence is of course the perceptible body. For it must not be forgotten that to Montgomery the living human organism, with its wonderful endowments, is the veritable *ens entium*. It is the basis of his epistemological structure. No notion of "gross matter" inheres in his concept of the visible man. "We touch heaven," said the devout Novalis, "when we lay our hands upon the human body." Montgomery has reared it scientifically to this pinnacle of piety. It is to him "the matrix whence issues into actual awareness in unbroken sequence the panoramic revelation of nature, conveyed in ever-changing kaleidoscopic combinations of sensations, perceptions, thoughts, feelings, cravings and emotions. Such a matrix," he says, "must be in all verity a genuine substance possessing the essential properties with which advanced philosophical thinking has been led to endow the inevitable notion of substantiality: a notion that alone rescues our world-interpretation from complete collapse into the abyss of idealistic nihilism." (*Philosophical Problems*, etc., page 109.) In further defense of the dignity of his conception of organization, he says (pages 197-8): "the visible organic commotion we call life, which is sustaining with its ceaseless activity all structures and all functions

of the living individual, reveals in its incomprehensible potency the profoundly mysterious nature of our real extra-conscious being, fully justifying us in regarding it as the veritable source of the flowing phenomena of our conscious content."

To establish his postulate as to the relation obtaining between morphological structure, its physiophyly and concomitant psychic manifestations, Montgomery spent years of patient toil as a microscopist in the study of proto-organisms. Here he found further reason for opposing the mechanistic doctrines of the physicists, particularly as they applied to vital phenomena and organic deportment. No physico-chemical hypothesis would cover the field, though many of the vital processes formerly classed as purely physiological he relegated to the realm of the chemical and physical. Nor have developments in the meanwhile served to eliminate the necessity of reckoning with an element "not amenable to the ordinary yoke of physical laws." The vaunted doctrine of endosmosis was heralded by Dutrochet as a veritable explanation of life itself. Later investigations, however, demonstrate that the intestines are lined with epithelial cells, themselves independent organisms considerably specialized, and that the protoplasm of these cells selects and appropriates proper nutriment in the same manner as do the ciliate infusoria. And this selective process unmistakably implies a nervous system. The psychical element, therefore, enters at an early stage as a factor in unicellular life; and as a functioning element plays a part in morphophyly not at all inferior to the physico-chemical forces.

What then is this most common and intimate thing called vitality?—"this intangible something whose formative potency draws to itself stray stuff from the visible world, coercing it into significant organic arrangement and prescient aimful activity?" Vitality, Montgomery

avers, is not a static property but the result of a dynamical process. "It is not the property of any kind of mere chemical compound. It is altogether a phyletically elaborated chemical process taking place in strict dependence upon, and interaction with, the stimulating influences of the medium."

As to the origin of life itself, Montgomery, of course, refers it also to molecular processes. He says (*Monist*, Vol. 5, No. 2): "Whenever a complex molecule, formed during the chemical elaboration of our planetary material, suffered slightest disintegration, that is, loss of any of its constituent elements, and was thereupon able to re-integrate itself by means of combination with complemental elements offered by the medium, there life had its beginning, . . . for its alternate disintegration and reintegration raised it from the sphere of lifeless existence into that of living activity."

That the protoplasmic individual is a chemical unit, Montgomery has discussed in an article entitled "The Dependence of Quality on Specific Energies," published in *Mind*, 1881, wherein he essayed to demonstrate that no number of qualitatively equal units can possibly, through any kind of aggregation or juxtaposition, produce by such summation anything qualitatively higher than themselves; no number of mere aggregations in whatever special position a higher chemical compound; no number of mere aggregated organic molecules a living organism; no number of merely aggregated elementary organisms a higher organism, and no number of merely associated psychical elements a higher mental phenomenon.

Mayer, as a corollary to his doctrine of the correlation and transmutation of forces, had proclaimed that vital activity was solely a display of transmuted physical forces, sustained and perpetuated as such by mere combustion of the appropriated nutriment. Muscle was only "a machine

through whose instrumentality is brought about the transformation of force.... It is not itself the material by means of whose chemical metamorphosis the mechanical effect is produced." Montgomery was amongst the first to attack this unphysiological view of vital organization, and in articles published in Pflüger's *Archiv* (1881) he announced his position after exhaustive studies of motility in micro-organisms and in muscular fibre. His claim was to have demonstrated that the force effecting vital movements is in reality "mass-manifestation of a definite cycle of chemical activity, occurring in the very substance which exhibits the motion."

Minimizing the importance generally attached to morphological appearances in biological study, Montgomery discarded the use of powerful re-agents in the examination of the visible details of organic structure as employed by Virchow and his school. He examined tissues in serum and, where possible, in their natural living state. Investigating microscopically in living muscles their structural movements, he found the striped protoplasm of such as had been detached from the body of insects, when immersed in distilled water instead of serum, to be suddenly converted throughout into fine, wavy, fibrous tissue similar to that of tendons. Then followed the rather startling discovery that this complete disarrangement of the striped structure of the muscular fibre was susceptible to perfect restoration on the addition of a little salt or sea-water, a substance chemically similar to blood. This experiment forced the conclusion that muscular fibre is not stable machinery mechanically moved, but that it consists of a substance possessing its own actuating principle, and that its minute structural organization is due to its intrinsic chemical constitution and the specific vital activity attaching to it.

In the logical development of his attack upon mechan-

istic theories he questioned some of their fundamental postulates, energy and motion themselves being labeled "abstractions." "In the whole range of thought," says Montgomery (*Monist,* Vol. 5, No. 2) "there exists no more fanciful belief than that which makes so utterly inconceivable an abstraction as pure energy or motion detach itself from a moving mass to seize upon another mass which it thereby energizes." The changes which are observed to occur in groups of physical existents are wrought by powers inherent in the interdependent agents thus manifesting the changes. "We become consciously aware of physical existents solely by their sundry characteristic activities stimulating our senses." These activities merely stimulate our senses, observe, not passing over into our being. In like manner motion merely stimulates changes in other physical compounds by affecting the latent energy within their own intimate and inalienable natures. Experiments in catalysis are corroborating these assertions more and more, while observations on the nature of radium have confessedly overturned theories of the conservation of energy. Even the theory of the kineticism of gases must assume in the gas-molecules the intrinsic endowments of elasticity and motion. Energy therefore is not transmissible and interconvertible. It is not only constant as an innate property of physical substances, but it is infinite and inexhaustible. The energy, for example, which manifests itself in this table to effect the visual sense would continue forever to emanate its subtle force without diminution of its stored potentiality. "Three principal facts fatal to the theory of the conservation of energy....are: first, the inseparability of an activity from that of which it is the activity; second, advantage of position due to forcible disequilibration; and third, the intrinsic inexhaustible power possessed by masses to resist and counteract over and over again with undiminished efficiency, within certain limits, any

external disturbance of their equilibrated state." (*Philosophical Problems,* etc., p. 291.)

Another of Montgomery's intellectual battles was waged against the cell-aggregation theories of biologists, in his contention for a purely unitary view of the organism. "The assumption of autonomous cells as aggregated constituent elements of the out and out organized unitary individual, and of the composition of such autonomous cells by a further aggregation of secondary units,. . . .gives rise to painfully labored, illogical theories of vitality and organization, wherein the imagined imperceptible units are, to begin with, arbitrarily endowed with all the properties they are invented to explain." (Page 161, *Philosophical Problems,* etc.) If this theory be true the diversified tissues of organisms must be products of a single reproductive germ-cell by a process of cumulative cell-division.

Somewhere Montgomery thus formulates the riddles involved in these germ-cell theories: "How do the myriads of differentiated cell-beings entering into the formation of a complex organism manage to become potentially represented in the initial germ-cell from which they emanate? and how do the potential differentiations enclosed in the germ-cell manage to evolve the adult organism?" Darwin, with his wonted frankness, fronts his provisional hypothesis of pangenesis with a scarcely less unsolvable enigma: "How can the use or disuse of a particular limb or of a brain affect a small aggregate of reproductive cells seated in a distant part of the body, in such a manner that the being developed from these cells inherits the characters of either one or both parents?" Verily the problems of regeneration and heredity are the fundamental problems and crux of biology; and their solution involves a mastery of the mysteries of the dim world of molecular activities. And here indeed is where Montgomery has sought his answer to the sphinx-riddle; for to him it is the morphological

output effected through chemical reintegration of the protoplasm of the spermatozoid with its inherent vital properties that forms the adult organism.

To Montgomery, protoplasm is not merely an aggregation of molecules preserved as a mass by physical cohesion, but an indescerptible unit, cohering under such specific chemical bonds as distinguish natural compounds. But its vital functions, "due to a definite cycle of chemical activities," operate independently, and involve the entire substance in "chemical solidarity." That vital process which develops the pseudopodium, and which causes it to withdraw again into the emanating substance, depends upon chemical avidity for restitution. Assimilation is merely reintegration through combination with appropriate pabulum, and this process, of course, involves the necessity of eliminating waste material. This final act in the catabolic process is accomplished by means of depurative vesicles. Assimilation does not involve on the part of the living substance a metamorphosing of the appropriated material into separate vital beings like itself, as generally believed.

Montgomery thinks this account of the constitution of the organic being lends itself readily as an explanation of the problems of reproduction. His experiments in ontogenesis verified this conclusion. He sliced into many parts the rather highly differentiated stentor, each of which parts developed a complete adult trumpet-animalcule. And this morphological restitution was accomplished, he asserts, "by dint of its unsaturated chemical affinities managing by degrees to reconstruct, through assimilation of complementary material, the chemical whole of which the fragments formed a part." Metabolism finds here, then, a proper and scientific explanation, as do fissiparity, the "budding" process, and all other forms of organic regeneration.

This, it must be confessed, simplifies matters encouragingly; but observers of karyokinetic phenomena and

other processes of fissiparous division of cell-nuclei will doubtless regard it as inadequate. It must be admitted that Montgomery's direct methods eliminate many of the difficulties injected into the problem by the cell-aggregation hypothesis. It would seem, however, that he is not wholly free from the philosophic vice of other biologists, so trenchantly attacked by him in referring to their "surreptitiously smuggling" into physiological units such plasomes as were required to potentialize them with their requisite characteristics. Montgomery's philosophic sins are not so subtilly devised. They consist of attributing to phyletic processes the development of qualities apparently incommensurable with the physical, chemical and vital substrata of his evolving substance. Memory and awareness "intrinsically originate" from protoplasm, in which they, in weak diffusion, inhere in the same manner as physical and chemical properties inhere in non-vital substances. Their progressive sentient and conscious modes are then phyletically developed outcomes, and structurally incorporated. The sublimation of that chemical reaction known as "irritability" into thought and the interpretation of relations between thoughts, seems a far leap. But his refutation of the theory of functional indifference of structural elements, as advocated by Lewes and Wundt, went far toward establishing his theory that all vital reactions are attributable to the intrinsic endowments of their living substance and its specific structural organization. He further fortified his position by devoting years of study to protozoic organisms, the results of which were published under the title, "The Unity of the Organic Individual" (*Mind,* 1881).

In this valuable contribution Montgomery explains how the all but homogeneous protoplasmic individual becomes developed into higher organism by reason of its substance being differentiated into a set of interdependent structures which become more and more developed. In transparent

Protozoa the whole cycle of activities in which vitality consists can be directly observed in its entirety and simplicity. The vital process brings nearly all the organism into interactive contact with the stimulating influences of the medium, and preserves its integrity and efficiency unimpaired. Moreover it leads to structural development, for function develops structure.

And here is the foundation of Montgomery's biological system. Primitive functions are phylogenetically elaborated. Structure concomitantly develops: not through conative or conscious processes, but through the activities of the complemental, stimulating, non-mental power-complexes beyond the conscious content,—entities which possess, he says, an apparently "creative trend." The muscular development of the athlete is no whit the result of any mental deposit. It is the inevitable effect of a transphenomenal creative activity of which consciousness and all mental processes are also manifestations. "Our fitful and fragmentary consciousness is not at all concerned in the never-flagging, vital activity whose toil alone maintains intact the high-wrought possessions of life."

The continuity then of organic life is strictly dependent upon "the maintenance of structural integrity and functional efficiency." Upon this rests the stability and consistency of the world as revealed in consciousness, and the preservation of our gradually acquired experience; for this latently retained and automatically memorized nexus of past experience has become inwrought into the ectodermic structures. Without this systematic structural fixation of the content of the past, there could exist no connatural experiential formulae, no conceptional consistency, no logical integrity, no formulation of universally valid concepts, no categories, no norms of reason, no truth. It is this structural identity, maintained despite changeful events and the experiences of manifold varying actions performed

and re-performed, that constitutes, according to Montgomery's creed, the veritable substance, which, as before stated, philosophers are driven to postulate in order to secure an unimpaired "issuing matrix" and a perduring support for the perpetual flux and identical re-issue of conscious phenomena. There is no other actually known substance that meets the philosophic requirements, for no other has the power to preserve its identity while emanating the changeful pageantry of the physical cosmos or of the phenomenal world of consciousness.

Looking then upon the human structure, so minutely and so significantly organized, Montgomery finds both biology and philosophy compel him to recognize it as the veritable entity in whose being the representative world of consciousness has been toilsomely fashioned in symbolical revelation. For here again let it be remembered that the perceptual mind deals only in symbols which but meagrely represent the transphenomenal entities of the real world. The images into which are translated the "ethereal vibrations" impinging upon our specifically attuned sensory substance can possess no qualitative parity with the extramental excitant of the molecular composition of the neural-threaded sense-organ. What the real character of this external, sense-stimulating, changeful but perduring entity actually is we have no powers for determining. But certain it is that within the vitality-touched fragment of the great external world which we call our body is fashioned the issuing matrix of consciousness, and all the mental activity which delivers our world-revelation.

Whatever intellectual giant man may prove to be here in his own sphere, he is, in reality, but a cosmic pigmy who owes all his gifts to creative powers incomprehensible to himself, and incommensurable to his own faculties. The belief in the nature-constituting efficiency of one of her late manifestations has led philosophers astray ever since

divine Plato elevated reason to supreme power. Philosophic problems have ever since been treated deductively from conceptual premises intuitively derived, mainly by assigning to hypostatized abstractions creative potencies, and regarding them as real objective existents. It is, however, becoming more and more evident that concepts are mere subjective, transitory mental representations of organized and synthetized actual experience, which must be scientifically verified as corresponding to conditions naturally given before they can serve as reliable data for reasoning processes.

Hume and Kant perceived that analytical propositions cannot enlarge our knowledge of reality; but they failed to discover how synthetical, knowledge-enlarging experience had wrought upon reason. Habitual association of given particulars, as Hume reasoned, or mind-made synthesis of given appearances, as defined by Kant, fails to give to concepts their necessary character of permanency. According to Montgomery the explanation lay in the fact that during the interaction of the organism with its physical and social medium, newly acquired experience becomes "creatively incorporated" into the structural matrix which preserves past experience, the entire organism being, in every detail of structure, a perceptible record of its entire racial experience. Concepts are therefore nucleated bodies of thought organically synthetized subsuming apprehended similarities, and lending themselves to "analytical judgments and dialectic evolutions in elucidation of experientially accrued knowledge." (*Philosophical Problems,* page 12.)

Thus at a considerable expenditure of mental effort, Montgomery refutes all conceptualistic theories that assign to intelligence creative potency. "Neither Plotinus nor Spinoza, neither Scotus Erigina nor Schelling, neither Leibnitz nor Hegel have, in their various attempts, in the

remotest degree succeeded in showing how the world of direct, actual experience can in any way be evolved from an ideally constituted Absolute, or indeed from any kind of ideally conceived substance." (*Philosophical Problems,* etc., page 21.) The "psychical force," a self-emanating activity postulated by Leibnitz, evolving its phenomenal products out of "an unsubstantial void," and the "hypostatized beingless abstraction" to which Fichte's non-substantialism reduced the creative agency are shown to be worthless as epistemological data. Spinoza's Substance is but an arbitrarily endowed essence of all potentiality, which Montgomery likens to pure white light potentially comprising all colors. "But," he asks, "whence the activity, the power that shapes the definite form, that breaks the single white radiance into variegated multiplicity; that segregates from homogeneous all-comprehension the special attributes of 'thought' and 'extension' which are held to constitute our world?" No answer is afforded, he says, by any absolutistic ontology. "Divine substance refuses rationally to tear its perfection to tatters. If it does so 'irrationally,' as Schelling maintains, it then becomes guilty of all the pitiful insufficiency that, then, follows from so degrading an action. Schopenhauer's pessimism is the consistent outcome of such a conception." (*Philosophical Problems,* page 24.)

Montgomery's own naturalistic conception of Substance, then, affords a relief from the rarified subtleties of the metaphysicians. Reason or intelligence in whatever form objectified or hypostatized, is possessed of no creative efficiency. Its sole function is that of rationally assisting the organism to adjustively meet the conditions of a social and physical environment. This ability is connaturally and concomitantly developed with its phyletic evolution, its increasing enlargement and specialization of

function being permanently and availably inwrought in structural exponents.

The ethical creed deduced from these naturalistic premises, with much else of interest, must be left without comment. Montgomery's books and papers should find a permanent place in philosophical literature. Sometime they will be credited with yielding an illuminating glimpse into the profundities of Nescience.

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CRITICISMS AND DISCUSSIONS.

"SELF-REALIZATION" AND THE WAY OUT.

As a theory the ethical doctrine of the English transcendentalists is reconstructive rather than constructive. Since Green's "Prolegomena" we have had from them nothing in the way of new and positive principles: at the most they have given us the formula of "self-realization," which they have derived altogether by criticism of the historical types of ethical theory. Though they differ from their predecessors in a more scientific psychology, better method, nicer illustration and finer literary style, they are still at the meeting of the ways, because they mistake a secondary for the fundamental fallacy in hedonism and rationalism, and thereby perceive not an original constructive point of departure for their own doctrine.

That fallacy is not, as the English transcendentalists take it to be, the sacrifice of the integrity of the self, on the one hand to sensibility, on the other to reason, but the greater sacrifice of infinite potentialities to an artificial general concept. In this essay I aim to point out the fundamental fallacy in rationalistic ethics, and to indicate a constructive way out for the self-realizationists.

We shall make a poor start if we attend at all to the traditional distinction between sensibility and reason and their ethical values. It is now a commonplace of moral philosophy that rationalism is quite unpsychologically founded. We shall begin well, if for a start we single out a central aspect of the Stoic ethics, against which modern psychology can direct a valid, but ignored, criticism. I mean the rationalistic attitude to "Fortune."

I.

In his *De Consolatione Philosophiae* (Bk. II, cap. 4) Boethius reports Wisdom as saying, "Adeo nihil est miserum, *nisi cum putes*; contraque beata sors omnis est aequanimitate tolerantis,"—which is almost a literal anticipation of Hamlet's reflection, "There's nothing

either good or bad but thinking makes it so." Modern psychology would develop these maxims in two directions. First: human consciousness, which only for analytic and expository purposes may be divided into special parts and separate processes, is the source of all value in the world, of good and evil in every sense. If we were merely automata—and in this day when we have talking machines and walking machines that do human things and feign human ends, the conception is not irrelevant,—conceivably we might come to make all those useful reactions on our environment which we now consciously make, but without thinking, they could be designated useful only by metaphor: to us as, *ex hypothesi,* automata, our environment and all its vicissitudes would be indifferent, neither good nor bad.

Now, by certain inveterate habits of thought, or under certain exigencies of explanation, we abstract from consciousness all its vital and sensitive content until it becomes merely cognitive. Then, forgetting that we have arrived by abstraction at this conception of the human mind as an *intellectus purus,* we submit that from reason alone the world and conscious existence derive all their value. But if consciousness were merely cognitive, we should at best be nothing more than intellectual automata; and thus our environment would be merely a system of mathematically related objects, devoid of all that would make life worth living. Only human consciousness, as phenomenally given in its integrity—cognitive, appetitive, and volitional through and through—can constitute excellence, establish ideals, and create an environment of good and evil.

Fortune, then, has no other origin than this:—it is the offspring, not, as the Stoics conceived it, of foreign and capricious fate, but of our own nature and idiosyncrasy. In other words, fortune is a short-hand term for all those things in the world which satisfy or dissatisfy our vital impulses, which are dear or repugnant to the heart, or delightful to the imagination.

Again: So far this is a very simple and obvious piece of psychology; but because the English transcendentalists, as before them the Stoics, consider only its subjective meaning, they miss its application and value in ethical theory. On the subjective side, while the Stoics saw that by negating the world, that by consciously willing to live without its goods, they could thus fortify themselves against "the slings and arrows of outrageous fortune," they did not see the deeper meaning of this attitude of spiritual detachment from the

world. Carry out this method of exclusion to its logical end, and it must result that there will be *neither a world nor a self at all.*

Modern psychology, on the other hand, taking for its datum the concrete phenomenal consciousness, not only names and describes our psychic processes in terms of the objects on which they function, but views these processes as constituting both the active substance and the content of the self. This is a method of *inclusion,* empirically based. But the inevitable abstraction which results from the subjective method of exclusion, led the rationalists, from the Stoics to Kant, to set up an artificial general concept as the real, essential self. As, in the view of the Stoics, the self could "cut loose" from fortune by denying the real existence of external goods, so, too, the soul could escape fortune by affirming only the validity and worth of intellectual processes as such. Psychologically viewed, this is not losing the self to find it, but finding the self to lose it in an empty form—and nothingness.

Under our analysis, it appears, fortune is but the complex of our possible interests objectified in our material, social and spiritual environment; and the concrete self is the complex of perceptive processes and vital reactions that create our demands, interests and ideals, and constitute the world of good and evil. Not, then, any abstract, formal divorce between sensibility and reason, but the insistence on a real, practical and absolute separation between the substance of consciousness and its content, between self and fortune (not-self),—this is the fundamental fallacy in all rationalistic ethics, from the Stoics to the English transcendentalists.

Let me add, before we proceed, that there is in this no tendency on my part to hark back to subjective idealism or solipsism. For, as we shall see, while the distinction of self from not-self is a function of the process of perception, in practice it becomes a futility and in ethical theory a superstition. The truth the distinction signalizes in ethics needs restatement. But as it stands historically in the system of the monists it is literally, in the Hellenistic sense, a σκάνδαλον,—a stumbling block. When we see how and in what sense this is so, we have found a constructive point of departure for the monistic theory of self-realization. To this we now turn.

II.

The charge of formalism, which the self-realizationists bring against Kant's doctrine may be as justly laid against their own; and, further, their concept of personality, for from being a principle

which overcomes the simple psychological dualism of the rationalists, only results in a profounder dualism. This outcome is altogether the product of certain stubborn incoherences of thought, abetted by an inherited apriorism.

When the self-realizationists work from the dignity and authority of reason—which means that, *a priori,* sensibility is held in contempt—they arrive at the "idea of self" as the constitutive principle of morality. I do not deny the validity and worth of this principle; but I affirm that the constructive principle of morality is no such abstract idea and has no such ground and origin in human nature as the English transcendentalists allege. The authority of reason does not come from itself, but from our irrational nature,—from our despised sensibility and the moral consciousness, of which reason and reflection are a part but the last part. Only a mind sophisticated by idealistic tradition and inveterate abstract reflection can credit reason with more inherent dignity and authority than it grants to sensibility.

If we reduce the matter merely to verbal propriety, it is the truth that far from feeling being, as it is traditionally conceived, the servant of reason, reason is the servant of feeling. But in reality it is so because vital impulse creates first the demand for life and next for rationality in organizing our faculties and energies. In short, the dignity and authority of reason and the rationalistic "idea of self" are but contents of that very consciousness which they are supposed to explain,—ideals which it creates and explains.

If the case stands thus with the transcendental "idea of self," if it is an empty *a priori* form, the self-realizationists must face a still graver charge: their apriorism creates a profounder dualism than anything Stoic or Kantian. We shall better see the truth of this if we observe how a member of the pluralist camp puts the case for the self-realizationists. Says Professor James Seth: "As the watchword of hedonism may be said to be self-satisfaction or self-gratification, and as that of rigorism [rationalism] is apt to be self-sacrifice and self-denial, so the watchword of eudæmonism may be said to be self-realization or self-fulfilment. It seems almost a truism to say that the end of human life is self-realization. The aim of every living being....may be described as self-preservation and self-development, or in a single term, self-realization....Moreover, every ethical theory might claim the term "self-realization," as each might claim the term "happiness." The question is, What *is* the "self"? or, *Which* self is to be realized? Hedonism answers, the

sentient self; rigorism, the rational self; eudæmonism, the total self, rational and sentient."*

Now, I submit, if to the ethical command "Realize thyself," the question keeps the form, "*Which* self?" then we shall only concern ourselves again with the old problem of the *relation* of sensibility and reason in the *individual,* and we shall never thus accomplish anything more than a tentative reconstruction of the broken fragments of the historical types of ethical theory. Positive construction will begin only with a direct empirical answer to the question, '*Who* (or *What*) is my self?' There is in this question no reference to sensibility or reason, or any merely conceived elements or processes of consciousness. For the question starts an immediate psychological investigation of the phenomenal consciousness as such, but soon rises out of its empirical confines into the metaphysical zone, without any violation of scientific method or human nature.

We proceed immediately from an irreducible datum of psychology. The teaching of to-day is apt to describe consciousness in terms of a few familiar characteristics: it is personal, always changing but sensibly continuous, selective, motor, etc. Paramount for ethics is the fact that all these are realized and expressed in another characteristic, namely, that consciousness is essentially *social.* However much theoretical psychology may insist on distinguishing in the process of perception the substance from the content of consciousness, the active knowing self from not-self, or "I" from "mine," we must recognize in practice that these are abstract and relative distinctions.

In its objective references, as well as in its inner essence, consciousness is an *inclusive* activity. Prof. William James rather understates, or too pragmatically puts, this truth. The "sense of the shrinkage [and enlargement] of personality" is, he says, "a psychological phenomenon by itself." It is not, however, so true that the concrete empirical self shrivels or expands, as that it actually *is* or is not, in direct proportion to the number and variety of the objects which appeal to sense and imagination and satisfy vital impulse. The phenomenon is an immediate and characteristic psychological datum. As, in perception, a taste which is not tasted, or pleasure which is not felt, is nothing, so in practice the self is zero if its activities center nowhere, and infinite if they have universal content and direction. The indisputable proof of this is no mere

* James Seth, *A Study of Ethical Principles,* 1st edition (1894), p. 204. The italics in the quotation are Professor Seth's.

pragmatic test, but the sense and emotion of personality in the presence of the world; we actually *feel* ourselves, not only real beings, but also greater or less individualities, according as our world and interests are widened or narrowed, recognized or ignored.

On the other hand, this psychological phenomenon is the first condemnation of the transcendental attitude to sensibility and reason and the disproof of the abstract "idea of self" as the constitutive principle of morality. Only a devotee of apriorism can dignify and sublimate the so-called spiritual processes of the self into a separate and authoritative unity on its own account, and name it *par excellence*—the self. Our bodies, family, possessions, and even our philosophies, no less han our spiritual processes as such, when they are intimately related to our finite organization and felt to be ours, are essentially part of the self.

We are ready now for the application, and for the formulating of our constructive principle. The immanent social function of consciousness—the innate tendency of self to inclusion of all reality—is the fundamental datum which the self-realizationists have ignored. In our view, the real and complete identification of self with universal reality is as much a psychological necessity as a moral ideal. In virtue of this social function of consciousness it is no longer possible either (1) to make self-consciousness idiocentric or (2) to split the universe into self and not-self. Without here at all passing into phenomenalism or solipsism, the ultimate and real distinction is between *the active, appropriating self and the potential self*. And, as in perception the apperceptive content of consciousness is the mind which makes experience from nature (not-self), so in practice the concrete social self constitutes morality from the potential self by appropriation and identification.

This distinction, from our point of view, is as relative and conventional as the distinction between selfishness and unselfishness: the difference is solely one of the universality and objectification of human activities and interests. "O Universe, I wish all that thou wishest," said Marcus Aurelius; and thus by identifying his will and interests with total reality, his own finite self became one with the universal self. This, then, is the constructive way out for the self-realizationists.

That the accidents of our physical nature, and of social and cosmic evolution, prevent the actual absorption of universal reality into the life of the human spirit, has nothing to do with the logical issue. The question, "*Who* (or What) is my self?" is already an-

swered. For objective reality—fortune, material goods, institutions, offices and humanity and God—stands over against the finite self, not as some absolute "other," but as its own potential self. The Absolute, that is to say, is my real and complete self.

I may point the matter familiarly in this way. When we read in the Scriptures that "God so loved the world," habitually we not only misplace the emphasis but also suppose that this act of the deity was wholly gratuitous and gracious on his part. But from the very nature of consciousness as social, anything less than the complete inclusion of the world (i. e., the totality of human spirits) in God's love was impossible. And so must it be in our own case. Anything less than the identification of our finite, actual self with the Absolute, who is our infinite potential self, is logically impossible and morally futile.

To sum up: When the self-realizationists charge the rationalists with reducing morality to formalism, we may justly reply that their own concept of personality is a pure *a priori* product and their "idea of self" an empty abstraction. Their apriorism confines attention too much to the subjective content and meaning of personality, and their maxim, "Realize self" compels us again to ask the traditional question, "*Which* self?" And thus we never get beyond the problem of the relation of sensibility and reason in the life of the individual as such. On the other hand, the inquiry, "Who (or What) is my self?" has a direct empirical answer in the social nature of consciousness. On this datum of psychology as a stepping stone, we may rise without fear of hindrance or contradiction into the metaphysical zone. To be sure, psychology has nothing to say as to whether the universe is a personality or not. But for ourselves, assuming the proof of spiritual monism, "Realize self" becomes a concrete, practical maxim. For although we must wait on experience and social evolution for the knowledge of the means of self-realization, we are always sure of the nature of self and the content of the moral ideal. "Realize self" now means, "In your own finite life fulfil and perfect the life of the Absolute Spirit."

J. D. Logan.

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A TWENTIETH CENTURY ZENO.

In considering any attempt to prove Euclid's parallel postulate, it is well to consider first what is meant by geometrical proof. In

defining some terms by means of others, it is obvious that we must begin primarily with some terms which are themselves *left undefined.* To *prove* any statement is to show that it follows as a logical consequence from relations already accepted, so that we must eventually begin likewise with statements for which *no proof is offered.* These initial statements are frequently called "axioms" but had better be called "assumptions," since we are at liberty to make choice of these statements in any way we please, subject to but one condition, namely, that they must not contradict one another. For an ideal system they must be likewise independent—that is, such that no assumption follows as a logical necessity from one or more of the others.

It will be apparent, therefore, that our ability to prove any theorem will depend upon our initial assumptions, and that without a knowledge of the assumptions employed, the proving of a statement is meaningless. Now from very early times it was thought that Euclid's parallel postulate could be deduced from his other assumptions, or, in other words, that his system was redundant; and the different places in the ancient editions occupied by this historic statement would seem to indicate that Euclid himself was somewhat in doubt as to the necessity of inserting it. Thus have arisen the attempts to prove this assumption—that is, to deduce it from his other assumptions; and though all these attempts have failed, they have nevertheless been most fruitful in illuminating the subject of the foundations of geometry. By making *some other assumption* we may easily prove Euclid's; for example, it is now customary to use some such modification of Playfair's assumption as "Through a point without a line there cannot be two parallels to the line." Such substitution, however, is not contemplated in an attempt to prove the parallel postulate.

Conversely, to *disprove* a statement, is to show that it contradicts, or leads to a contradiction of, some other statement logically deduced from the original assumptions. That one discredits a statement is no more a logical objection to it than is one's credence to be regarded as logical proof. One is at liberty to *replace* any assumption of an ideal system by any other likewise independent of the remaining assumptions and evolve a geometry differing materially from the former, the sole logical criterion being that of consistency; but one is *not* at liberty to *add* assumptions, not contemplated by the author of a proposed system, nor can the latter be held responsible for contradictions or inconsistencies in consequence of the liberty

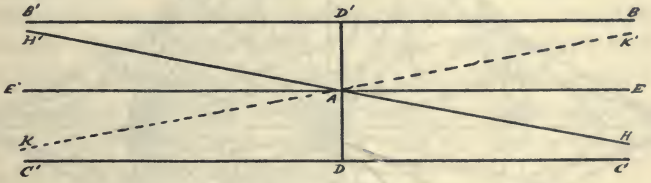
so taken. Now the geometry of Lobatchevsky consists in *replacing* Euclid's parallel postulate by an assumption which we may express thus: "Through a point not on a given line we can have more than one line not intersecting the given line," the system being, of course, co-planar. Any logical objection to the resulting system must not therefore assume the Euclidean postulate directly or indirectly by employing some theorem which is based on this postulate.

These considerations are evidently overlooked by the writer of "A Modern Zeno" in the April number of *The Monist*. For example, he says (page 294):

"Now a right-angled isosceles triangle may be dissected into two other half size right-angled isosceles triangles by a line drawn from the mid-point of the hypotenuse to the vertex of the right angle...."

If the author can prove this statement without using Euclid's parallel postulate, or one equivalent to it, his demonstration will be by no means "an imputation upon the reader." If, as we are certain will prove to be the case, he finds it necessary to use this postulate, then he has *added* it unlawfully to the system of Lobatchevsky and is himself responsible for all resulting incongruities.

On page 301 he considers the following figure, where BB′ and CC′ are perpendicular to DD′, A being the mid-point of DD′ and AH a parallel to DC through A:



He shows (as is easily seen by symmetry) that AH′ || D′B′, and then shows apparently that

B′D′B || H′AH,
H′AH || C′DC,
and therefore B′D′B || C′DC.

He seems to overlook the fact that in the geometry of Lobatchevsky parallelism is a *sensed relation,* a fact apparent enough, however, in the author's own quotations, as for example,

"We must allow two parallels, one on the one and one on the other side" (page 292).

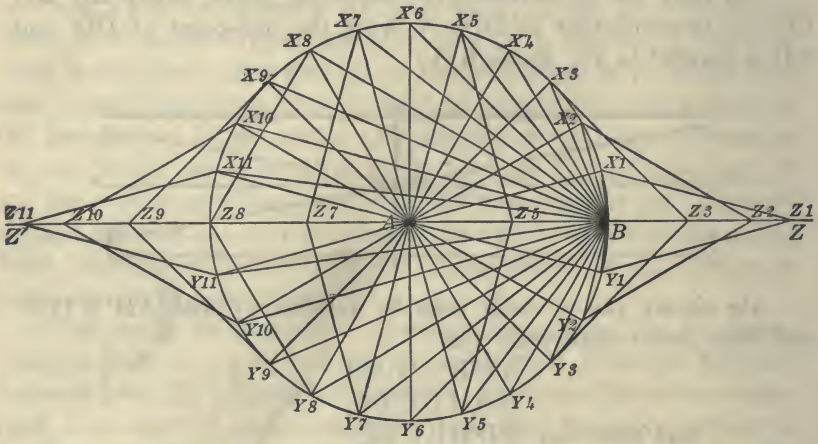
"Under this assumption we must also make a distinction of *sides in parallelism*" (page 292).

"The farther parallel lines are prolonged on the side of their parallelism, the more they approach one another" (page 294).

In other words, if AH || DC, then AH is *not* parallel to CD. By keeping this in mind one can easily discover the fallacy of his course of deduction "no step of which is unsanctioned by the 'system' of Lobatchevsky" (!) by which he proves that in the above figure KAK′ is parallel to HAH′. These, among many other fallacies to which attention might be called, show that the author's criticism of the system of Lobatchevsky is not very formidable.

The author appears to be likewise unfortunate in his constructive work. In proposing a definition for a straight line, he says (pp. 304 and 305):

"Take any two points, say A and B. With, say, A as a turn-point (it might just as well have been B) and with the interval AB as the compass opening, scribe the circle BX_1X_2, etc. clear around complete. Then with B as turn-point and with *any* opening of the compass, short of 2AB, mark off on the first circle two points, say X_1 and Y_1. The same will be, of course, at equal intervals from B. Then from each of the points so marked scribe circles with the compass opening the interval AB. Such circles will all pass through A, but besides that they will otherwhere intersect and determine a point as, say Z_1" (Z probably stands for Zeno).

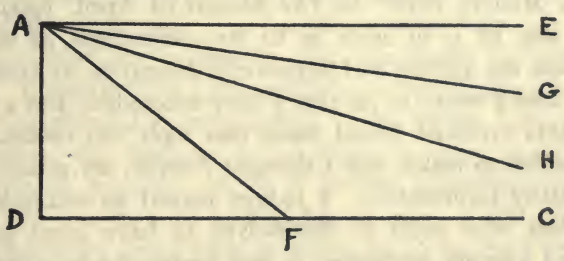


Now what is AB? A straight line segment (or *sect*, to use Dr. Halsted's happy term)? If it be a sect, then he is using a sect in defining the property of straightness! If it be not a sect, then what significance has 2AB? In speaking of the points X, Y, Z, he assumes (apparently unconsciously) that under certain conditions which he does not explicitly set forth, two circles may have two common points, but no more. The condition under which they have

only one common point is involved in his construction by circles centered at X_6 and Y_6, yet logically he cannot consider this important exception to his own statements. Again, in assuming that two circles cannot have three common points he is virtually assuming Euclid's parallel postulate with a few theorems included. The conditions under which they have two common points require for their consideration the definition of points within and without a circle, which definition requires a comparison of *sects,* the conditions involving in their ultimate analysis the assumption that a *straight line* through a point *within* a circle has one point (and therefore two points) in common with the circle! Also, the transition from an aggregate of distinct points (and these ununiformly distributed) to that of a continuous line is, if not impossible, at least quite difficult.

Another point which should be considered is that of simplicity in the initial assumptions; just as chemistry is founded on elements and biology begins with single cells, so geometry should have for its basis the simplest possible assumptions, each consisting, so far as possible, of a single statement. It was in all probability, the complexity of Euclid's parallel postulate, "If a Right Line, falling upon two other Right Lines, makes the inward Angles on the same side thereof, both together, less than two Right Angles, those two Right Lines, infinitely produced, will meet each other on that Side where the Angles are less than Right ones," which maintained interest in it, even if it did not afford the initial grounds for suspicion, rather than with regard to the relatively simple assumption which usually immediately precedes it, "Two Right Lines do not contain a Space." This simplicity which is in accord with the treatment of geometry by all modern critics is at variance with the course pursued by the author of the article in question.

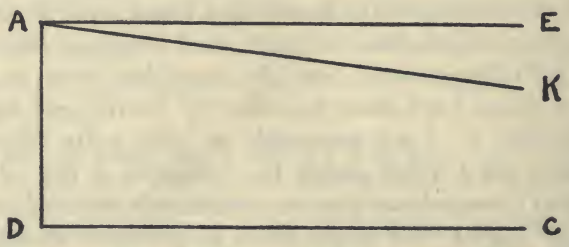
Again, referring to AH as the boundary of lines from A cutting DC, as AF, and not cutting DC, as AG, he says (page 297),



"But he definitely puts his parallel among the lines that do not cut. But how about the relation of that parallel to the next line, that is, the last of the

lines that cut DC? Does it make an angle with the parallel or is it the same line?"

Consider the same argument in connection with the following figure in orthodox Euclidean geometry, where AE and DC are perpendicular to AD and are therefore parallel. All other lines (or *rays*) in the angle DAE intersect DC. Let AK be "the last of the lines that cut DC. Does it make an angle with the parallel or is it the same line?....



"If the lines make an angle I suppose that that angle can be bisected, indeed *n*-sected, and such section-lines will be lines that neither cut nor non-cut. If the lines are only one single line then we have a line that both cuts and non-cuts."

Of course this argument is entirely fallacious, but it applies equally badly, nevertheless, to the geometry of Euclid and to Lobatchevsky. Other portions of the article are, of course, equally vulnerable.

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DUNBAR, PA.

Mr. F. C. RUSSELL STILL DEMURS.

To the Editor of The Monist:

I wish to thank the Editor for his considerate notice of my article "A Modern Zeno" in *The Monist* of April, 1909. I think, however, that he is in error as to my assumption of the straight line. It was my special and paramount solicitude to avoid that assumption, and it seems to me that I have succeeded. But a discussion of the points involved would make this reply too prolix.

I intended to make, and I thought I made, my article a distinct *plea for better information.* I judged myself an example of a numerous class who seem to themselves to have good geometrical faculty, and who are warranted in that persuasion by a body of confirmations independent of their own esteem, and yet who are per-

plexed and mystified as they study to understand the non-Euclidean doctrines. So I judged it to be eminently conducive to my purpose to exemplify in my article the manner and fashion after which such minds as mine are apt to conceive and deal with the elements of geometry. I hoped that my gropings would more or less reveal to the non-Euclideans the matter or matters at fault in my class of minds, and that some one or more of them would take the pains to so explain their doctrine as to put it within our compass.

I am a little surprised to observe that some of my critics presume a hierarchy in the domain of mathematics and would have the truths of geometry and the issues arising therein depend upon the authority of that hierarchy. Now while I am in no wise indisposed to defer largely to such an authority, I must protest that any blind subjection would outrage the crowning honor of mathematics, viz., that, unique among the sciences in that regard, it asks absolutely nothing on the ground of authority but appeals solely to insight and reason. Geometry, especially, walks by sight and not by faith.

Besides, the matters I agitate pertain to the very elements of geometry, and as to these how is it that the professional expert has, on account merely of his professional expertness, so much the advantage of the amateur? Of course professional expertness is an index of intellectual quality, but if other things be equal (an important condition truly) how is the professional expert better fitted to see more lucidly in dealing with the elements of geometry than any other person of good geometric faculty?

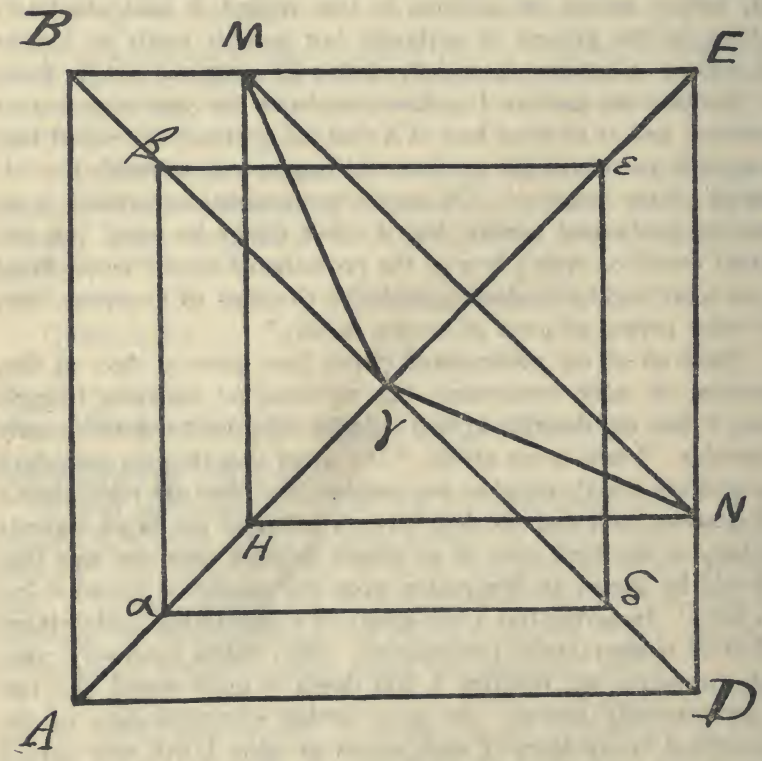
Since all of my professional critics have gone at once at that discourse of mine concerning the right-angled isosceles triangle I take it that my doctrine in that point is regarded as conspicuously vulnerable. I said in my article, "The proof that the two secondary triangles are exactly equal to one another, that they are right-angled and isosceles, and that the four tertiary triangles are in all respects precisely in the same case, is so simple in more than one way that it would be almost an imputation upon the reader to spread it before him." In saying this I was guilty of a mortifying inadvertance and of an unwarrantable presumption. Still, unless I am very, very sadly mistaken, the doctrine I laid down is quite sound and can be geometrically proved. So as a further exemplification of the geometrical inveteracies of such minds as mine I will now spread before the reader in detail what seems to me to be good geometrical proof of my proposition.

Consider and refer to the following figure.

Here are three quadrilateral figures ABED, $\alpha\beta\epsilon\delta$ and HMEN. They are really squares, but as yet we do not know that and so we will for the present call them *even rhombs*. (The word "even" will get its justification in due course.) ABED we will call the *outer* even rhombus, $\alpha\beta\epsilon\delta$ the *inner* even rhombus and HMEN the *corner* even rhombus. $\alpha\beta\epsilon\delta$ and HMEN are equal as we shall see. Each rhombus has two sets of triangles, for example, in the outer even rhombus ABED such triangles as ABE, BED, etc., to be called here its *major* triangles, and such triangles as AγB, BγE, etc., to be called here its *minor* triangles. So far all is loose preliminary, intended only as an aid in understanding the language I use.

The figure is constructed as follows:

Draw the straight line AαH$\gamma\epsilon$E and the straight line B$\beta\gamma\delta$D so that they intersect one another at γ at right angles. Take the



points α, β, ϵ and δ so that any one of the intervals $\gamma\alpha$, $\gamma\beta$, $\gamma\epsilon$ and $\gamma\delta$ shall be equal to any other of them. Join α and β, α and δ, ϵ and β, and ϵ and δ, by right lines. The four minor triangles $\alpha\gamma\beta$, $\alpha\gamma\delta$, $\epsilon\gamma\beta$

and $\epsilon\gamma\delta$ are made. Since any and every one of these triangles have been made right-angled and equal-sided about the right angle and any one side equal with any other, any one of the triangles is equal to any other of them, and hence any one of the sides $\alpha\beta$, $\alpha\delta$, $\epsilon\beta$ and $\epsilon\delta$ is equal to any other of them. Furthermore on account of the equality and isosceles nature of these (minor) triangles any one of the eight angles $\alpha\beta\gamma$, $\beta\epsilon\gamma$, $\epsilon\delta\gamma$, $\delta\alpha\gamma$, $\alpha\delta\gamma$, $\delta\epsilon\gamma$, $\epsilon\beta\gamma$ and $\beta\alpha\gamma$ is equal to any other of them. Since we do not as yet know how these angles last mentioned compare with the right angle, and since it will be necessary to have immediately a name for them we will for the present call such angles *u-angles*. These *u*-angles are not in any wise indeterminate. They are just as determinate as is the right angle, and they might be defined as being such angles as the sides of an isosceles right-angled triangle make with the hypotenuse. Only it is not yet determined how they compare with the right angle.

The angles $\alpha\beta\epsilon$, $\alpha\delta\epsilon$, $\beta\epsilon\delta$ and $\beta\alpha\delta$ being each and every one of them composed of two *u-angles*, are, on that account, as yet undetermined in their relations to the right angle, but they are indeterminate in no other respect. We will for the present call such angles *w-angles*. Any one of them is equal to any other of them. The four *major* triangles of the inner even rhombus, $\alpha\beta\delta$, $\epsilon\beta\delta$, $\alpha\beta\epsilon$ and $\alpha\delta\epsilon$, being each *w*-angles between pairs of equal sides, any one of which sides is equal to any other of them, are any one of such triangles equal to any other of them. The thoroughgoing evenness of the inner rhombus should now, I think, be abundantly manifest.

Now take A and E on the line $A\alpha H\gamma\epsilon E$ and B and D on the line $B\beta\gamma\delta D$ so that any one of the intervals γA, γB, γE and γD shall be equal to either one of the (equal) sides of the inner even rhombus. Join A and B, A and D, E and B and E and D with right lines. Then there will be made an outer even rhombus with minor triangles, the sides of the rhombus, the angles of the minor triangles, the corner angles of the rhombus, the major triangles, etc., all equal homologously as in the inner even rhombus, such angles as ABD, BAE, etc., being *u*-angles and such angles as ABE, BED, etc., being *w*-angles.

Now take on BE the point M so that the interval EM shall equal the interval $E\gamma$ (or the equal interval $\beta\epsilon$, or etc.) and take on ED the point N so that the interval EN shall equal the same interval as above prescribed for the interval EM. Take on the line $A\alpha H\gamma\epsilon E$ the point H so that the interval EH shall equal the interval BE

(or the equal interval AB or etc.). Join M and N, M and H, M and γ, N and γ, and N and H with straight lines.

Now pursuant to Euclid I-V, MH equals Bγ which equals Eγ, either being equal to βε (or etc.) which equals ME which equals EN (or etc.), and pursuant to the same Euclidean theorem, NH equals Dγ which equals Bγ, etc., so that MH equals NH and so that any one of the four sides, MH, NH, ME and NE, is equal to any one of the others. Now the angle MEN being a *w*-angle equals the angle βεδ, while the sides of the triangle MEN, viz., ME and NE, are both equal to each other and either side equal to either side of the triangle βεδ. Hence the two triangles MEN and βεδ are equal. But the triangle NHM equals the triangle MEN (three-sides equal). Now the angles MHN and MEN have heen shown to be both *w*-angles, and since the triangle MEN is equal to the triangle βεδ it is further shown that the angle EMN which corresponds to the angle εβδ (or etc.) is a *u*-angle and that the angle ENM is also a *u*-angle is shown by a precisely like argument. But since the triangles EMN and HMN are equal, the angles HMN and HNM are also *u*-angles, so that the angles HME and HNE are shown to be *w*-angles. Now the triangles αβε and HME have the angles αβε and HME equal to one another (both being *w*-angles), which angles are in either triangle included between a pair of sides equal to each other and equal any one such side in either triangle to any such side in the other triangle. Hence the two triangles are equal and the side αε is equal to the side HE which was made equal to the side BE of the outer even rhombus. But it has just been shown that in the triangle αβε the side αε is equal to the side BE of the triangle BγE, and it was heretofore shown that the side Bγ (or Eγ) was equal to the side βε (or βα). Hence the triangle αβε is equal to the triangle BγE and the angle αβε homologous to the angle BγE is equal to the same. But BγE is a right angle. Hence the until now named *w*-angle αβε is now shown to be no other than a right angle, and its half, the until now called *u*-angle, is shown to be precisely half of a right angle.

The rest now goes almost of itself. In a right-angled isosceles triangle the acute angles are half right angles and equal to either one of the sections of the bisected right angle of the triangle. Hence in such a right-angled isosceles triangle the line from the vertex of the right angle to the mid point of the hypotenuse divides the primary triangle into two equal *isosceles* right-angled triangles, and the bisecting line is precisely one-half of the hypotenuse. Of course if

the above argument is sound the angle-sum of the right-angled isosceles triangles, at least, is precisely two right angles. If this is true I suppose it to be not very difficult to prove first that the angle-sum of *any* right-angled triangle is the same, and then that the angle-sum of any triangle is the same. There is very possibly some flaw in my course of argument. I can only say that up to the present time I have not been able to detect it.

It is objected against my remarks on the system of Lobatchevsky beginning about the middle of page 301, Vol. XIX of *The Monist* (April, 1909 number) that I have ignored the fact that Lobatchevsky distinguishes between sides in parallelism and that the statement of his Theorem 25 ought to be glossed by inserting the words "on the same side" in about the middle of that statement. Some of my critics make this gloss in their statement of said theorem. I avow that I honestly thought that the omission of the condition was deliberately designed by Lobatchevsky, for it seems to me that the reason of the matter justified the omission. Let us see. Lobatchevsky says in effect (Theorem 16—[*Monist,* Vol. XIX, pp. 291-292]) that in the uncertainty that obtains whether there may not be other lines than the perpendicular AE that do not cut DC, he will assume that such lines are possible, in plurality. The boundary line of such lines he takes as his parallel and, of course, makes it make the angle $\Pi(p)$ an angle less than a right angle. This leads him to remark that on the assumption he makes there will be two lines through the same point both parallel to the BDC line. This is *his* distinction of *sides in parallelism,* and it goes no further. As to such an idea as that two lines may be parallel if they are taken in the same *sense,* and yet *not* parallel if taken in opposite senses, I fail to find any vestige of it in Lobatchevsky's text. That would be to make Lobatchevsky's system a system of vectors instead of a geometry, and I am sure such a system as well as the idea of a *sensed relation* would put me to permanent intellectual confusion, should I endeavor to find any sense in either of them.

But Lobatchevsky, in his Theorem 17, stated thus, *"A straight line maintains the characteristic of parallelism at all its points,"* shows by his figure and demonstration that he had plainly in mind that a parallel was parallel as well on the other side of the $\Pi(p)$ line as on the one side. So I fail to see how my figure on page 301, April 1909, *Monist,* and my remarks in connection therewith ignore or violate any of the principles laid down by Lobatchevsky. I did not aver that he drew the consequences that I did. I plainly started

out with the remark, "But it is time to search for results ourselves," and it seems to me that I showed that the principles of Lobatchevsky lead to contradiction. At any rate, I cannot see how the distinction of *sides in parallelism* avoids the consequences I drew. It is true enough that Lobatchevsky, keeping (with the single exception I have mentioned) always on one side of the $\Pi(p)$ line, falls into no contradiction. With a parallel differing only infinitesimally from the ordinary parallel, and keeping always on the same side of the $\Pi(p)$ line, how could he fall into contradiction? It may be noticed in passing that Lobatchevsky makes nothing whatever turn upon any of the assumed plurality of lines that lie between his parallel and the perpendicular AE. It is probably of no consequence unless for the notice it gives us that so far as the system of Lobatchevsky is concerned there are no lines on the same side that pass through A that are of any consequence except the perpendicular AE and the parallel AH, the latter differing from AE by only an infinitesimal shade.

I cannot admit that my definitions of the straight line and the plane are amplifications of definitions previously published in Professor Halsted's *Rational Geometry*. Had I so esteemed them or either of them, I should not have published them as my own. It would be quite idle, however, for us two to dispute over the matter. We are both on record and whoever feels interest enough in the issue to inquire will decide irrespective of any clamor of ours. I may say, however, that definitions are a matter of words, apt for the publication of enough of the proper marks of the thing defined to make fully determinate all the other proper marks without making any use of the thing defined either expressly or by implication. I do not, as does Professor Halsted, make the straight line and the plane "aggregates of points." True, in leading up to my definition I make use of triads and aggregates of points. But when all is ready I drop those ideas and define a straight line as a certain kind of a *line*, and a plane as a certain kind of a *surface*, neither of which would I think of defining as an aggregate of points. As a matter of fact much of my method in geometry is the result of a practical business with linkages. Almost any one can see that my straight range is a virtual though mechanically unrealizable linkage. I may say that I have a linkage of thirty-seven links, any link of which is identical with any other link, with which linkage with two points fixed I can by continuous motion draw a limited straight line (in fact two) in line with the two fixed points. But this linkage did not

reveal the essence of the straightness of the straight line, as did the straight range. The latter is three-dimensional. The former only planar.

If it be asked what use can be made of my definition of the straight line, I can only say that I have not as yet found it of as much use in elementary geometry as I had anticipated. I can say, however, that it follows quite readily from the definition that two-intersecting straight lines can have only the intersecting point in common, and quite as readily that the straight line cannot return into itself; that is to say, that the straight line is infinite, a result which alone would sadly mar the symmetry of the non-Euclidean system.

CHICAGO, ILL. FRANCIS C. RUSSELL.

AN OPEN LETTER.

To the Editor of The Monist:

It was with great interest that I read your reply, in *The Monist* for July, to my article entitled "A Biochemical Conception of the Phenomena of Memory and Sensation" which appeared in the same number. It is not my intention to attempt anything approaching an exhaustive critique of the philosophical position which you assume, —an attempt which, as some four thousand years of sterile discussion have demonstrated, would be entirely useless. I am nevertheless constrained to draw your attention to certain points in which I am of the opinion that you have not represented my position, and that of a number of scientific colleagues, with that fairness which, I believe, we have a right to expect from the editor of a journal "Devoted to the Philosophy of Science." Since a charge of misrepresentation affects not only the accused, but also his readers, I have taken the liberty, Sir, of addressing you in the time-honored form of an "open letter."

In the first place, Sir, I must take exception to the style in which you have expressed yourself concerning my formulation of my hypothesis of memory in mathematical terms, and in which you have alluded to Professor Loeb's term "associative hysteresis," which he has proposed to substitute, in scientific literature, for the popular term "memory." I know that any suggestion that the mathematical or scientific author is seeking to "impress" or mystify his readers by the use of mathematical symbols or of scientific terms is welcomed by that type of general reader, who, with the common dislike of

humanity for concentrated and specialized effort of any description, is angered by the suggestion, which such terminology conveys to him, that there are problems which cannot be solved off-hand by virtue of a superficial acquaintance with the semi-popular literature of the subject,—that there are intellectual goals which cannot be won without effort,—or, to return to the instance in hand, that the recondite problems of brain-physiology, or, as you prefer to term it, psychology, cannot be solved by one who has not at least that degree of technical knowledge of the subject in hand which is required by the Artisan who would construct a steam engine. I recognize, I say, the literary effectiveness of your mode of expression, —but I deny its legitimacy. Your appeal to prejudice is unworthy of you, Sir.

But to return to questions less personal than that of controversial style.—On page 390 of your article you state your hypothesis of parallelism as follows: "There are not two separate factors, the psychological and the physiological, running parallel to each other, but there is one reality which has two aspects,—the one being the internal or subjective, the other the external or objective. The two are as inseparable and yet different as the internal and external curves of a circle." If I recollect my Euclid aright, a circle is a line which is without breadth, so that the internal and external curves are coincident and identical. Doubtless you will reply to this that I am pushing a material analogy to the extreme,—that I am taking advantage of an unavoidable imperfection of illustration. But I too am employing analogy, and my illustration of the difficulty which attaches to your theory is more pertinent than it may at first sight appear. What, I inquire, is the "one reality" to which you refer? In what does it differ from the "substance" of Spinoza? In what do the "two aspects" of the "one reality" differ from his "attributes"? Are they not merely the expression of that disparity between the extent of our "internal information" concerning our own cerebral states, and that of our information concerning the cerebral states of others, upon the origin of which I have dwelt in my article? To pursue our analogy further,—is there any space which separates the internal from the external curves of the circle, —and, if so, what is its content? I will refrain, however, from pursuing the metaphysical side of our discussion further,—metaphysical beliefs are so essentially temperamental in origin that the only logical end to such discussion, between courteous controversialists, is agreement to differ.

Your reminder that Professor Haeckel employed the expression "gaseous vertebrate" in reference to the anthropomorphic conception of the deity and not in reference to the dualistic conception of the soul was not, perhaps, wholly necessary. Professor Haeckel's works are well known and widely read, and it may be presumed that a writer does not quote such an expression without being perfectly aware of the connection in which it was employed by its author. Yet my extension of the phrase to include the dualistic conception of the soul is not, I venture to affirm, so inapt as you would appear to believe. I grant that the philosophers themselves have, perhaps, never represented the soul in this manner,—but then it is universally admitted that philosophers are men of exceptional intelligence. Would you seriously seek to deny that the dualistic conception of the soul, which is held by the rank-and-file of the uneducated and of the cultured alike, is not that of a "gaseous vertebrate, immanent within but independent of the material organism"? How, then, would you account for the belief in ghosts,—so generally denied, so universally entertained,—for the success of its fashionable expression,—the spiritualistic séance?

I am, however, constrained to call you to account for yet another and a more serious misrepresentation. On page 396 of your article you state that: "In spite of the merits of Professor Loeb especially in the line of physiological experiments, in which specialty he has distinguished himself, we can not see that psychology would be helped by calling some definite reactions which take place under some definite conditions 'tropisms.' We do not gain a scientific comprehension of these transactions until we gain an insight into the mechanism which upon a definite irritation causes organized life to move in a special direction and in a special way." While I, in common, I believe, with all my biological colleagues, heartily endorse the second of the above two sentences, it is possible that I share with a number of your readers an inability to perceive the precise connection between the two sentences,—or, I may mention in passing, the exact nature of the part played by "the merits of Professor Loeb" in the question under discussion. Do you really suppose, Sir, as your statement would appear to imply, that the term "tropism" is nothing other than a name employed by Professor Loeb to conceal lack of "a scientific comprehension of these transactions"? Since it is impossible to suppose that this implication is a deliberate attempt to misrepresent, one can only conclude that you are either unacquainted with the literature on the subject

of Tropisms, or else that you have utterly failed to grasp the significance of the evidence presented therein. True, the evidence is as yet, in the main, of a qualitative rather than of a quantitative character,—but we learn from your article that the "notion of quality" is "tolerated" by you, and this fact should therefore not deter you from perceiving that the investigations which have been carried out by Loeb and his pupils have at least carried us some way towards "an insight into the mechanism which upon a definite irritation causes organized life to move in a special direction and in a special way";—that they have shown that these movements can be controlled by physical and chemical means and are therefore, in all probability, the expression of physical and chemical occurrences within the organisms; and, finally, that they have shown that many of the more complex reactions which we term "instincts" are analysable into simpler elements which are tropisms, i. e., controllable by physical and chemical means. If, indeed, you do not perceive in Loeb's theory of tropisms anything other than an empty nominalism,—it is regrettable, but it does not deprive the theory of its value, even in the exclusive domain of psychology. You will recollect Wordsworth's character of whom it is said:

> "A primrose by the river's brim
> A yellow primrose was to him,
> And it was nothing more."

It is usually conceded that these words were not intended to imply default on the part of the primrose,—I leave the further pursuance of the analogy to you, Sir.

Abandoning, however, the language of metaphor (although, Sir, in view of your artistic reference to the Sistine Madonna, I may be pardoned my short excursion into the realm of poesy), and returning to the more prosaic vocabulary of scientific discussion, I venture to insist that a statement of a theory is not, in itself, adequate evidence of its validity. It is a simple matter to propound theories, Sir, but it is quite another matter to apply to them the test of fact,—indeed it is for this reason that philosophies and religions are so incomparably more popular than science.

In objecting to a theory which is supported by experimental evidence the burden of proof is thrown upon the objector,—he is expected, in scientific discussion, to demonstrate that the theory to which he takes exception is insufficient, and, if at the same time he advances a theory of his own, to demonstrate, not only that his theory is sufficient where the other is insufficient, but that it is also

in agreement with the facts upon which the opposing theory was based. In your article I find a statement of a theory of memory, which regards this phenomenon as an expression of "the preservation of living forms," and I find it stated that my theory of memory is inadequate. Yet I am unable to ascertain from your article what are the facts with which you support these statements. I find, in your article, statements based upon statements, and I find hypotheses evolved from preconceptions, but I do not find statements based upon facts.

Finally, Sir, I may be permitted to draw attention to the misleading nature of your dictum that "Professor Robertson's reduction of this statement to a mathematical formula, $\log n = Kr + b$, where n is the number of syllables memorized, r the number of repetitions, and K and b are constants,.... adds nothing to the explanation of the phenomenon itself." While it is perfectly true that the mathematical formulation of an hypothesis adds nothing whatever to the content of the hypothesis, yet when that mathematical formulation is applied to quantitative measurements, and the identity between the demands of theory and the facts of experiment is established, then much is added to the "explanation of the phenomenon itself," for the validity of the hypothesis is rendered proportionately the more probable. Quantitative evidence differs in no respect from qualitative evidence, save in the fact that the qualities compared are expressed in numerical units; but since the acquisition of qualitative must necessarily precede that of quantitative evidence, our knowledge of a phenomenon is the more complete the more it assumes a quantitative character.

T. Brailsford Robertson.

University of California.

DR. EDMUND MONTGOMERY.

Dr. Montgomery is a unique figure in the philosophical world. Having been a prominent member of the Concord School, he belongs to the history of this country, though he has contributed voluminously to the periodicals of the Old World, and is credited with having blazed new paths into biological fields.

By descent, Scotch; by birth, English; by education, German; by residence, American, Dr. Montgomery's life has been more than ordinarily eventful; yet he wrote recently in response to a request for autobiographical data: "Long ago I resolved that if a call should

come during my lifetime to furnish notes concerning my personal history, I should ask permission to keep silence with regard to everything not directly connected with my work. I think that with the exception of very eventful careers, run by extraordinary characters, it is inflicting a grievance on the reading public in these crowded times to thrust one's personal matters upon their attention. It would not greatly disappoint me to learn that my name and personalities would not long be remembered; but it would discourage me to learn that after close examination my biological researches and my thoughts proved not to have probed deeper, a little deeper than hitherto, the secrets of life and nature."

At Frankfort young Montgomery participated enthusiastically in the German Revolution of 1848-9, following with absorbing interest the parliamentary discussions, and eventually taking active part in the building and defense of the barricades. It was here, too, he experienced struggles with the problems of religion which drove him almost to suicide. Susbsequent years brought him into intimate relations with many of the world's foremost workers in science and philosophy.

While on the Medical Staff of St. Thomas' Hospital in London, and in consequence of a dissecting wound, his lungs became effected. Residence in a milder climate seemed imperative. He went, therefore, greatly dejected, to Madeira. There his medical practice increased overmuch, and placed too great a tax upon his strength. Again changing residence, he went to the Riviera and eventually to Rome. But tiring of having no settled home, he harkened to the call of the new world, whither friends, similarly afflicted and instigated with the same ideals had preceded him, sending back most encouraging reports. In the year 1873 he purchased the Liendo Plantation near Hempstead, Texas, where he has ever since lived, enjoying until lately good health, and devoting himself to his cherished biological researches and philosophical studies.

His wife was the well-known sculptor, Elizabet Ney, whom he first met in his school-days at Heidelberg, and whom he married at Madeira in 1863. Together they shared the joys and sorrows of life, engaged in their separate fields of labor, until June 1907, when the artist-wife, after an illness of about one month, died of heart disease. In October of that year an article by Mrs. Bride Neill Taylor appeared in *The Open Court* which gives a detailed account of the life and work of this famous artist, and is accompanied with illustrations of her most notable works of art.

Dr. Montgomery worked out his philosophy in a period when metaphysicism was confronted with materialism, and no middle ground was recognized. Being a physician by profession, and having specialized his work in physiology, Dr. Montgomery was too much of a naturalist to accept the idealistic horn of the dilemma, while, on the other hand, he was too well acquainted with the insufficiencies of naturalism to fall a prey to materialism. So he steered a middle course and found a solution of the world-riddle in "vital organization." His solution consisted in pointing out, with much attention to detail, the mystery of mysteries which is the wonderful activity of purpose-endowed life with its powers of choice and self-adaptation; and so it was but natural that his whole philosophy is tinged with a poetical mysticism.

The matured fruit of Dr. Montgomery's life has appeared of late in a stately octavo volume of 462 pages, entitled *Philosophical Problems in the Light of Vital Organization,* and we deem it proper to have a summary of the work presented by a man who, for more than twenty years, has been an ardent admirer of the Scotch-German-American hermit-philosopher of Texas. We cannot help thinking that Dr. Montgomery's solutions of the several problems are often unsatisfactory, however elegantly they may be worded. They discuss, but do not adequately answer the questions presented, and sometimes read more like prose poems than philosophy. But he assigned himself large tasks, tasks that involved intellect of an unusual type—the periscopic sweep of the pansophist and the thoroughgoing patience of the scientific specialist. *In magnis voluisse sat est.* So Dr. Montgomery is a remarkable figure, and as we do not mean to restrict the pages of *The Monist* to our own type of thinking, we gladly welcome to our columns a presentation of Dr. Montgomery's philosophy of "vital organization." EDITOR.

MALAY NOT ACCEPTABLE.

To the Editor of The Monist:

There are one or two points in your remarks in the July *Monist* where in my opinion you seem to err. You consider the present situation as a good parallel to that when Volapük fell. It is a parallel in one way, but a counterpart in another. The Volapük reformers did have to create an entirely new language, on a basis vastly different from Volapük. It did, of course, take them many years to bring out "Idiom Neutral," and in the meantime they could not but lose the great public. *Now,* the public is simply invited to choose

between two ready made dialects which are so similar that the transition can be made after an hour's study. The main idea is that many arbitrary features have been removed, and international ones, known to everybody, substituted. Both Ido and Esperanto recognize exactly the same principles, theoretically. In one sense the strenuous opposition of the Esperantists (which is much more vigorous than was that of the conservative Volapükists) is a good sign, even for the Idists. It proves that if even a language with relatively large imperfections can take root so strongly with many, Ido will, after it has overcome this resistance, be well-nigh proof against all attacks and further reform attempts, so far as they shall concern more than trifles. It may take a few years time to get there; but then things will settle down to a state of great relative stability.

As to Malay: are you not afraid that *The Monist* would look *a little* queer in that tongue? Have the Idists deserved a suggestion of *that* caliber, or are you in earnest in imagining that the European-American world would be inclined to relinquish the forms of thought that have come to them in two thousand or more years of history? You said something at a time about "*improving living* languages," and we are trying to present the quintessence of western European speech, with everything *a priori* strictly excluded. Between modern English, modern Malay, and an unheard-of though ingenious pasigraphy you seem to have touched several of the possible extremes; what's the matter with a scientifically constructed *a posteriori* tongue *as a compromise?* O. H. MAYER.

EDITORIAL REPLY.

In reply to Mr. Mayer's questions, I will say that probably the European-American world will not be any more "inclined to relinquish the forms of thought that have come to them in two thousand or more years of history," for the sake of Malay than for Esperanto or Ido. I believe that they will simply go on improving their own speech and world language will thus develop in the natural way. An artificial language should in my opinion not reject the *a priori* elements, but on the contrary should be based on them. It ought to be an algebra of thought constructed *a priori,* and the *a posteriori* meaning ought to be inserted just as in mathematics algebraic symbols whenever applied receive a definite meaning. Upon the whole we may leave the formation of an international language to its fate and watch the efforts of those who try to construct it artificially with critical sympathy.

BOOK REVIEWS AND NOTES.

LETTERS TO CASSITE KINGS FROM THE TEMPLE ARCHIVES AT NIPPUR. By *Dr. Hugo Radau, Ph. D.* Price $6.00. Royal quarto; paper covers.

This is marked Volume XVII, part 1, of the Cuneiform Texts of the Babylonian Expedition of the University of Pennsylvania; and in it Dr. Radau gives us 190 pages of preliminary discussion and notes, and 80 beautifully engraved plates and photogravures of 131 cuneiform texts from the archives of the temple of En-lil at Nippur in Babylonia.

The Cassite dynasty of Babylonian kings reigned for nearly 600 years; from 1814 to 1238 B. C. according to the chronology favored by Assyriologists. And yet their exact racial origin is still undetermined. They were certainly neither Sumerians nor Semites, as the character of their names sufficiently indicates. Their especial title was "King of Karduniash," a name that still awaits explanation. The most likely guess identifies them with the Kossaeans of the Zagros river, while their original home was, some say, in Northern Elam, and others even suspect Hittite affiliations.

But although Babylon was their chief and capital city, yet Nippur was ever their favorite residence; and the official title which they most greatly valued was that of *shakkanakku Enlil,* or "Lord Chancellor of the god Enlil." All transactions of and for the Temple needed their seal [*kanaku*] to be legal, so that every Cassite ruler was also, in a special sense, the High-priest-king of Nippur.

Furthermore, the period during which these tablets were written, namely 1440 to 1320 B. C., was a most vital epoch. For then, for the first time so far as we know, Babylonia came into communication with age-old Egypt on the one hand, and was attacked, on the other hand, by the newly rising power of Assyria, to this time belonging the famous Tel-el-Amarna cuneiform tablets of Amenhotep III and IV. The Berlin museum has three letters of the Cassite Kadashman-Bel to Amenhotep III; and 4 letters of Burnaburiash II, the son of Kadashman-Bel, to Amenhotep IV (the heretical Khu-en-Aten), the son of Amenhotep III, while the British Museum has a cuneiform tablet written by Amenhotep III to Kadashman-Bel; and two written by Burnaburiash to Khu-en-Aten.

Then, we have in 1421 B. C., the punitive invasion of Babylonia by Asshuruballit, King of Assyria, for the purpose of avenging the assassination by the rebellious Cassites of their king Kara-Hardash (or Kadashman Harbe), the husband of Muballitat-Sherua, the Assyrian King's daughter; and of seating upon the Babylonian throne Kuri-Galzu II, their young son and heir, who was the Assyrian King's grandson, the temporary Cassite usurper Nazi-Bugash being either driven out or slain.

This is the first evidence, with the two exceptions yet to be noted, of the existence of Assyria, hitherto apparently a mere vassal colony, but destined to grow ever more powerful for the ensuing 800 years. The only evidence of any earlier contact is found, first, in the "Synchronistic History" from Asshurbanipal's library, wherein it is stated that nearly nine centuries previous, in 1500 B. C., a treaty had been made between Asshur-bel-nishishu, King of Assyria, and Kara indash, the "king of Karduniash"; this latter being also the as yet unexplained title employed for Cassite rulers in the letters of Amenhotep III and IV, previously noted.

And the other mention of Assyria is in the tablet, also noted above, in which Burna-Buriash writes to Amenhotep IV, warning him against encouraging in their plots the Assyrians, "my vassals."

The tablets under review, however, published by Dr. Radau, and written, as their title states, *to* and not *by* Cassite kings, deal with no such lofty themes as international history or diplomacy. On the contrary they are merely business documents from the Nippur temple archives, many of them nominally or formally addressed to the sovereign, as the titular chancellor—while practically they are merely requisitions for urgently needed supplies from the surly and parsimonious Head-Bursar of the temple. Other letters, again, are reports by generals, architects, or physicians of the temple, and all ranging in their dates from the reign of Burna-buriash II (1440 B. C.) to that of Shagarakti-Shuriash (1320 B. C.) and Kashtiliashu (1309 B. C.)

Extremely useful tables of the masculine and feminine names, and those of places, gods, etc., etc., occurring in the tablets, close Dr. Radau's introductory text. And then follow the 80 finely engraved plates and photogravures, showing in all 131 inscriptions; so that, manifestly, the publication is designed, like the others in this series, not for the general reader, but rather for the student and expert in Sumerian andAssyriology.

And to such a one Dr. Radau's exquisitely clear transcriptions of the texts will surely be of the utmost value. Those who have at any time endeavored, with straining eyes and befogged brain, to identify—let alone coherently read—even a few of the signs upon one of these overcrowded and wellnigh illegible half-baked or unbaked clay tablets, will appreciate to the full the vast labor Dr. Radau has undergone, and the great amount of eye-strain, temper, and time, the subsequent student is spared.

Indeed in the tablets themselves we have an amusing illustration of their inherent difficulties and obscurities even to the men who wrote and used them, for one writer, about 1370 B. C., dejectedly complains that he had requested "earthen pots," but his correspondent had misread, and sent him "*straw*"!

Now if an old Babylonian of 33 centuries ago could make such a blunder in his own script; surely we alien scholars of so widely different a race and age, can be pardoned if we too occasionally err.

In closing we may note that the dates for the Cassite dynasty adopted by Dr. Radau and Assyriologists in general, are earlier, by about 50 years than those favored by Egyptologists, who give either 1383 to 1365 B. C., or 1377 to 1361 B. C. as the date of Amenhotep IV; thus making Burna-buriash II, who was his contemporary for seven years, reign from about 1401 or 1395 to 1376 or 1370 B. C., in place of 1440 B. C., as preferred by Assyriologists.

Dr. Radau, the author, Dr. Hilprecht, the editor, and the University of

Pennsylvania are all to be warmly congratulated on this addition to their series. For it will be an enduring monument to the ripe scholarship of Dr. Radau and of his mastery of the exceedingly difficult script, languages, and history of early Babylonia.

ALAN SPENCER HAWKESWORTH.

HISTORY OF THE MEDIAEVAL SCHOOL OF INDIAN LOGIC. By *Satis Chandra Vidyabhusana.* Calcutta: Calcutta University, 1909. Pp. 188.

This is a pioneer work in so far as the author has scarcely any predecessors in the field of Indian logic. Buddhist logic has been treated by several scholars, but for his sources of the Jaina logic he has to fall back mainly on unpublished and unedited manuscripts scattered all over Western India and the Deccan, and also preserved in some libraries. The book would have been more useful to Western people if he had considered the general ignorance of Sanskrit which prevails outside of India. A Western reader will probably be deterred from venturing into further study of the book if he reads the first sentences: "Logic is generally designated in India as Nyaya-shastra. It is also called Tarka-shastra, Hetu-vidya, Pramana-shastra, Anviksiki and Phakkika-shastra." (We here replace in this quotation the accented "s" by "sh.")

Since the book is meant for Sanskrit scholars this is scarcely a drawback, but we would suggest to the author if in a future edition he would feel the need of elaborating his work, to take into consideration also the uninitiated who are willing and anxious to learn. The book is very scholarly and is a new evidence that the Hindu race has worthy representatives who are well-trained thinkers. The book is divided into two parts: (1) The Jaina Logic, pages 1 to 55, and (2) The Buddhist Logic, pages 57 to 144. Three appendices contain some historical notes about the university of Nalanda (about 300 to 850 A. D.), and the Royal University of Vikramasila (about 800 to 1200 A. D.)

DIE DREI WELTEN DER ERKENNTNISTHEORIE. Von *Dr. Julius Schultz.* Göttingen: Vandenhoeck & Ruprecht, 1907. Pp. 104. Price, 2.80 m.

Dr. Julius Schultz is a philosophical author who writes in a popular and sprightly style. In criticizing the views of others he employs sometimes the weapon of humor without however yielding to malevolence. He points out that the philosopher starts with the data of experience, but the question is, what are these data? The logician declares that thought is given; the sensualist, sensation; and the empiricist, the naive world-conception of man. Dr. Schultz shows that a point commonly overlooked is the question, to whom are the data given; for the same object may be different to different observers. The first world of which he speaks is the empirical world, which has to be analyzed through the forms of thought, or as Kant would say, the categories. The second world is truth, and the object of the second world, matter. The third world, when trying to attain to ultimate certitude, is not, as Descartes says, *cogito* or the "I think," nor is it as his critics would say, *cogitat,* an impersonal thinking, but the imperative *cogita.* The last certitude is the content of every moment. It is the psychical expansion of our life, or as Dr. Schultz expresses it in his native and untranslatable German, *das Erlebnis des Erlebens.*

Our author lacks perhaps the method of a trained philosopher, but his mode of treatment is nevertheless interesting because he is possessed of common sense and is entertaining even where his ultimate thought is still subject to criticism.

SEMITIC MAGIC. Its Origin and Development. By *R. Campbell Thompson.* London: Luzac, 1908. Pp. 283. Price, 16s. 6d.

This volume forms a very interesting contribution to Luzac's Oriental Religions Series. The theories contained in it are based on a most careful study of the development of demonology in Western Asia from the time of the cuneiform incantation tablets through the periods of rabbinical tradition, Syriac monkish writings and Arabic tales down to its present survival in modern Oriental superstition. Studied in connection with the parallels offered by Aryan and Hamitic notions, these superstitions combine to throw light on the origin and significance of many of the peculiar customs of the Old Testament. The author divides his subject in the light of certain deductions gleaned from a particular study of the characteristics of the evil spirits which the Semites believed to exist everywhere. These deductions, bearing on the primitive systems of tabu, are as follows: (1) all evil spirits could inflict bodily hurt on men; (2) the relations between human beings and either evil or divine spirits were close enough to allow of intermarriage; (3) from this belief in intermarriage with spirits originated the sexual tabus; (4) since a man might suffer from an unwitting tabu it was necessary to exorcise the demon by transferring the evil influence to some external object; (5) from this idea arose the atonement principle and idea of sin offering; (6) from this stage would naturally arise the substitution of sacrificial animals for the first born.

The book is furnished with a careful and detailed index, followed by a list of Biblical quotations.

THE BURMESE AND ARAKANESE CALENDARS. By *A. M. B. Irwin.* Rangoon: Hanthawaddy Printing Works, 1909. Pp. 92. Price, 5s. net.

This book serves as a second edition to "The Burmese Calendar," published in 1901, but the author states in his preface that he has been able so to complete by further researches his former work that he is fully justified in giving it a new title. This is made necessary by including the Arakanese calendar together with the Burmese. The book is carefully prepared, the author's object being to make it intelligible and useful to both Europeans and Burmans. Mr. Irwin first describes the calendars as they are, next he shows certain errors in these calendars and points out their cause, suggesting also some alterations. The last part of the book consists of tables by the aid of which English dates may be changed into Burmese and *vice versa.* Tables I to III cover a period of 262 years, table I serving for past years and the others for the future. Table IX supplies the means for changing any date within these years from one calendar to the other.

HINDU TALES. Translated by *John Jacob Meyer.* London: Luzac & Co., 1909. Pp. 305. Price, 8s. 6d.

This volume is an English translation of the *Ausgewählte Erzählungen* of Jacobi, to whom the author dedicates his work. With regard to the interest

of the stories here collected the translator sums them up in his preface with the following criticism: "The first story in the following collection is decidedly the poorest—a most insipid and tiresome performance. The tales increase in interest as we go along. The novella of Muladeva, which comes toward the end of the book, will fascinate many a reader. From the literary and from some other points of view the best of all these selections is the last —the poem of Agadatta. So I hope the general reader will not despair when he is confronted at the very outset by that wooden statue of a sensualist called Bambhadatta. The student will find much valuable matter in all the stories."

ETUDES SUR LÉONARD DE VINCI. Par *Pierre Duhem.* 2. ser. Paris: Hermann, 1909. Pp. 473, Price, 15 fr.

This second series of studies on the most versatile of Italians, consists of four parts, of which the first treats of Leonardo da Vinci and the two infinites, the infinitely great and the infinitely small. The second part discusses his relation to the plurality of worlds. The third compares him with Nicholas de Cues, that philosopher of the Middle Ages who in his liberality of thought was virtually not a Mediæval philosopher at all, but an over-conservative modern. The fourth part deals with Da Vinci and the origin of geology.

L'ANNÉE BIOLOGIQUE. Comptes rendus annuels des travaux de biologie générale. Publiés sous la direction de *Yves Delage.* Paris: Soudier, 1909. Pp. 508.

The 11th number of this valuable annual has come to hand. It gives a comprehensive survey of all the work done in the biological field in the year 1906. Its preliminary essay is on *Les colerations vitales.* It reviews work along 20 special lines as divided in as many chapters, and each of these chapters contains discussions of perhaps 50 authors and their publications in magazine and book form. Thus specialized the annual is of invaluable service to the specialist in any branch of biology, whether he is most interested in the cell, fertilization, ontogenesis, heredity, variation, or any other of the 20 main subjects included.

BIOLOGY AND ITS MAKERS. By *William A. Locy.* New York: Henry Holt & Co., 1908. Pp. 469.

In this volume Professor Locy undertakes to bring under one view the broad features of biological progress, including not only the various phases of the evolution theory, but also the other features of biological research, some knowledge of which is essential to an intelligent comprehension of the former. He has endeavored to increase the human interest by centering his story around the lives of the great leaders in the various movements. The book is divided for convenience into two sections. In the first are considered the sources of the ideas that dominate biology, while the doctrine of organic evolution on account of its importance is reserved for special consideration in the second section. The text is illustrated very fully with portraits. Some of the rare ones are unfamiliar even to biologists, and have only been discovered after a long search in the libraries of America and Europe. The first

chapter treats of the origin and history of biology in general. Then follow chapters on Vesalius, Harvey, the pioneer microscopists, the minute anatomy of the 18th Century, Linnæus, Cuvier, Von Baer and the rise of embryology, the cell-theory, protoplasm, Pasteur, the theories of Mendel, Galton and Weismann on heredity, and fossil life. In the second part evolution is defined and the various theories of Lamarck, Darwin, Weismann and De Vries are discussed in detail.

The following books have been received at this office:

Dr. P. Häberlin, *Herbert Spencers Grundlagen der Philosophie*; eine kritische Studie. Leipsic: Barth, 1908. Pp. 205. Price, 5.40 m.—Josef Popper, *Voltaire,* eine Charakteranalyse, in Verbindung mit Studien zur Aesthetik, Moral und Politik. Dresden: Carl Reissner, 1905. Pp. 388.—Josef Popper, *Fundament eines neuen Staatsrechts.* Dresden: Carl Reissner, 1905. Pp. 86. —Charles S. Myers, *A Text Book of Experimental Psychology.* New York: Longmans, Green & Co., 1909. Pp. 432.—Wilbur Marshall Urban, *Valuation, Its Nature and Laws*: Being an Introduction to the General Theory of Value. London: Swan Sonnenschein & Co., 1909. Pp. 433. Price, 10s 6d.—William Wilberforce Costin, *Introduction to the Genetic Treatment of the Faith-Consciousness in the Individual.* Baltimore: Williams & Wilkins, 1909. Pp. 45. Price, 65 c., mail, 71 c.—Raymond Weill, *Les origines de l'Egypte pharaonique.* 1re partie, "La IIe et la IIIe Dynasties." *Annales du Musée Guimet.* Paris: Leroux, 1908. Pp. 510.—Edward Bradford Titchener, *A Text-Book of Psychology.* New York: Macmillan, 1909. Pp. 311. Price, $1.30.—Charles Gray Shaw, *The Precinct of Religion in the Culture of Humanity.* London: Swan Sonnenschein, 1908. Pp. 279.—Dr. Berthold Kern, *Das Problem des Lebens* in kritischer Bearbeitung. Berlin: August Hirschwald, 1909. Pp. 592.—Arnold Reymond *,Logique et mathématiques*; Essai historique et critique sur le nombre infini. Saint-Blaise: Foyer Solidariste, 1908. Pp. 218. Price, 5 fr.

We are glad to welcome Volume IV of the New Schaff-Herzog Encyclopedia of Religious Knowledge which proves to be a monitor of the passing of time as it marks the end of another three months with the precision of the calendar. Its range is from "Draeseke" to "Goa." It contains articles of interest in archeological, historical, biographical and purely religious subjects treated by specialists. A few suggestive headings are Duns Scotus, Erasmus, Dunkers, Eastern Church, Egypt, France, Society of Friends, Eden, Ecstacy, Faith, Gesenius. This volume is also furnished with a bibliographical appendix which brings bibliographies for the articles contained in all four volumes, down to July, 1909.

The collected works of A. Spir, edited by Helene Claparède-Spir, are now complete in two volumes. (Leipsic: Barth, 1909. Pp. 390, Price 8 m.) The second volume which has just appeared contains his essays on "Morality and Religion" and "Right and Wrong," besides some lesser miscellaneous writings.

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